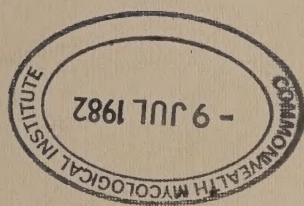


annual report

department of agriculture and fisheries



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**1 april 1980 to
31 march 1981**





REPUBLIC OF SOUTH AFRICA

ANNUAL REPORT

of the

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for the period
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General Statistics

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General Statistics

Report of the Director General: Agriculture and Fisheries for the period 1 April 1980 to 31 March 1981

THE HONOURABLE THE MINISTER OF AGRICULTURE AND FISHERIES,
PRETORIA

Sir,

I have the honour to submit herewith the Annual Report of the Department.

Dr D.W. Immelman
Director General: Agriculture and Fisheries

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1. Introduction

Agricultural and marine resources are of vital importance in enabling the State to ensure the material and spiritual welfare of the people of South Africa. The establishment of the Department of Agriculture and Fisheries in 1980 made it possible, for the first time, to formulate an all-embracing policy for agricultural and marine development and provide the machinery for executing this policy in a carefully planned and co-ordinated manner.

The optimum utilisation of agricultural and marine resources is fundamental to the Department's task of supplying food and fibre to the inhabitants of the country and so providing the material basis for the maintenance of the South African economy.

OPTIMUM AGRICULTURAL DEVELOPMENT

Optimum land use became established as the basis for agricultural production by 1970, following an investigation into the use of agricultural land in the Republic. This principle implies that agricultural production should take place in harmony with the environmental factors, not at the expense of the natural resources, and on a sound economic basis.

The concept of optimum land use involves more than the physical production processes, however. Rather, it could be formulated as optimum agricultural development, with optimum agricultural resource development, orderly marketing and price stabilisation measures, with financing and assistance, as the three basic principles. In the nature of things the entrepreneur is the central figure in the realisation of the national strategy of optimum agricultural development.

The practice of farming in harmony with the environment requires that the agricultural resources be classified in order to demarcate fairly homogeneous farming areas, establish yield standards and production techniques for fairly homogeneous farming areas, lay down guidelines for adapted branches of farming and the combination of such branches in respect of the fairly homogeneous farming areas, undertake appropriate technical and economic research through which higher yield standards can be set, improve production techniques and obtain fuller information on adapted branches of farming, singly and in combination.

The orderly marketing of agricultural products and price stabilisation measures are indispensable in the agricultural industry. They give stability of the industry. Agricultural production in the Republic of South Africa is a risky undertaking and, in view of the future demands that may be

made on it, it is essential that there should be confidence in the industry. An orderly marketing system also requires that certain inspection services should be operated in order to maintain standards.

Agricultural financing is the third basic principle on which optimum agricultural development depends. Because of the riskiness of the agricultural industry and the special circumstances under which agricultural production takes place, special financing facilities are essential in order to create confidence in the industry and give it the necessary stability. It is therefore a requirement that long, medium and short term capital should be made available in such a way that the special needs of the agricultural industry are met.

The view is held that optimum agricultural development is dependent on optimum agricultural resource utilisation, an orderly marketing system, price stabilisation measures and effective agricultural financing - as witness the fact that assistance schemes in terms of existing legislation are applied and funds are made available where this is justified.

The following 18 Acts provide the foundation for agricultural resource utilisation:

- Soil Conservation Act, No. 76 of 1969
- Subdivision of Agricultural Land Act, No. 70 of 1970
- Weeds Act, No. 42 of 1937
- Animal Diseases and Parasites Act, No. 13 of 1956
- Animal Slaughter, Meat and Animal Products Hygiene Act, No. 87 of 1967
- Agricultural Pests Act, No. 3 of 1973
- Agricultural Research Account Act, No. 37 of 1964
- Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, No. 36 of 1947
- Fencing Act, No. 31 of 1963
- Plant Breeders' Act, No. 15 of 1976
- Plant Improvement Act, No. 53 of 1976
- Registration of Pedigree Livestock Act, No. 28 of 1957
- Dairy Industry Act, No. 30 of 1961
- Tobacco and Wine Research Accounts Act, No. 60 of 1960
- Livestock Improvement Act, No. 25 of 1977
- Livestock Brands Act, No. 87 of 1962
- Wine and Spirit Control Act, No. 47 of 1970
- Wine, Other Fermented Beverages and Spirits Act, No. 25 of 1957.

The marketing system is applied in terms of the Marketing Act, No. 59 of 1968. The National Marketing Council and the various control boards function under the Marketing Act. The Act makes provision for the sale of agricultural products, the establishment of boards pertaining to such products, the establishment of a national market

and the grading and standardisation of agricultural products, and for related matters. The 21 control boards are responsible, in terms of various schemes such as the fixed price schemes, the single channel pool schemes and the floor price schemes, for the marketing of about 80 % of total agricultural production. In addition to the Marketing Act there are five other Acts that play a part in the marketing system, namely:

Co-operative Societies Act, No. 29 of 1939

Commission for Fresh Produce Markets Act, No. 82 of 1970

Egg Production Control Act, No. 61 of 1970

Abattoir Industry Act, No. 54 of 1976

Agricultural Produce Agency Sales Act, No. 12 of 1975

In the marketing of agricultural products the co-operatives act as co-ordinators of the supply to the markets and as reception points, packers, processors, storers and dispatchers. The direct marketing of uncontrolled products is carried out individually or collectively by central co-operatives, and controlled products are handled by agents of the control boards concerned.

The agricultural marketing research undertaken by the Department comprises research on agricultural economics and the assembly, processing and making available of statistics, all with the aim of promoting the efficient marketing of agricultural products. The fields into which the activities of the Division of Marketing Research are divided are the identification of trends in agricultural economics, the measurement of agriculture's contribution to the national economy, the estimation of crops, wool production and livestock numbers, domestic marketing research, overseas marketing research and the making available of information and statistics.

The financing of the process of agricultural development is a vital aspect of the endeavour to achieve optimum production and development. Agricultural financing takes place through the Land and Agricultural Bank (which falls under the Minister of Finance), commercial banks and other private financing institutions (including the agricultural co-operatives) and from the funds provided by the Department of Agriculture and Fisheries in terms of the Agricultural Credit Act of 1966.

The funds made available in terms of this Act are used to assist persons who practise farming or undertake to practise it, and the Act provides for the exercise of control in respect of assistance given and for other cognate matters. Whereas funds are made available by other bodies with the purpose of providing capital for farmers who are already strong in this respect, the funds provided in terms of the Agricultural Credit Act are intended to assist less affluent farmers with purchases of land, production loans etc.

Interest subsidies and crop insurance are areas of financing that do not fall under the Agricultural Credit Act.

Funds are made available during disaster droughts. *Ad hoc* financial assistance is given to

industries when the need arises. The Work Committee on the Economic Position of the Farmer and Agricultural Financing in General (the Jacobs Committee) makes a recommendation to the Ministers of Finance and of Agriculture and Fisheries in cases where an investigation is ordered by the two Ministers.

The co-operatives play an important part in financing the farmer; they supply production credit and make advance payments to the farmer on products delivered, or they may supply complete financing for the production of products which they then receive as agents of control boards. In case of droughts or other natural disasters co-operatives also serve as a link through which financial assistance by the State may be channelled to the farmer and they accept liability for the repayment of loans made available to the farmer for this purpose.

FOUNDATIONS OF POLICY

The basic elements for the formulation of a comprehensive policy for agricultural development have already been identified. This is a task in which the Department of Agriculture and Fisheries has a decisive role to play in consultation with the farming community, the South African Agricultural Union and the private sector. It will take the combined endeavours of all concerned to achieve the ideal of optimum agricultural development. In order to achieve this ideal - which includes the sustained provision for the growing need for food and fibre - some aspects of present activities will necessarily have to be given greater emphasis.

Owing to the rapid increase in the population, the accompanying urbanisation and the creation of infrastructures, the danger of good agricultural land being used for non-agricultural purposes is increasing. It must be clearly stated that the preservation of good agricultural land and the conservation of agricultural resources in general, with a view to the optimum utilisation of the land of South Africa, are not negotiable. The question arises, however, whether the instruments at the disposal of the Department at present are adequate for the application of this principle.

Shortcomings in the agricultural structure during the past 50 years have given rise to several investigations. One of the results has been that the unprecedented cutting up of and speculation in agricultural land during the sixties has largely been halted by legislation. However, this has been accompanied by a trend towards large-scale land ownership and the depopulation of farms - an evil that is apparently not generally recognised as one but that requires urgent consideration.

The agricultural industry is the biggest single employer of unskilled labour. Good labour relations and productivity are vital to the industry - two key factors that will require more attention from the entrepreneur, in view of the ever-increasing production costs.

The financing of agriculture for optimum development has become very important in the establishment of the maximum number of

financially sound owner-farmers in agriculture. The enormous discrepancy between the market value and the agricultural value of land makes it virtually impossible for financial institutions such as the Land and Agricultural Bank and the Agricultural Credit Board to finance the land purchases of potential farmers.

With regard to marketing, it appears desirable for the fixed price schemes that exist in terms of the Marketing Act to be reviewed again. In view of criticisms of these schemes and the problems known to be associated with them, it will be necessary to reconsider both the principles and their application.

It is perhaps not sufficiently realised that South Africa has reached the stage where the horizontal expansion of production is no longer possible and that vertical expansion is already interlinked with the concept of optimum agricultural development. It necessarily follows that research, extension and training have a decisive part to play in the process of making optimum use of the limited and dwindling agricultural resources.

Agricultural research and extension are fundamental long-term inputs without which optimum agricultural development could not be achieved. At the moment agricultural research and extension do not receive the priority warranted by the actual situation, *inter alia* for the following reasons:

- * Thanks to the research achievement of the Department and other bodies, the growth in agricultural production over the past years still exceeds population growth, an achievement that obscures the possibility of food shortages and excessively high prices in future.
- * The Department is experiencing a shortage of funds, both for expanding its research and development activities and for attracting its rightful share of the scientific and technical manpower.

In view of this the terms of reference of the Committee of Enquiry into Services to Agriculture are very important.

On the basis of the facts at our disposal on both human and natural resources, and in view of the demands the future is likely to make, the question arises whether it is not time to consider a comprehensive agricultural development Act. Such an Act would have to embody a strategy aimed both at development and essentially at planning - a strategy in which elements related to the utilisation and conservation of the agricultural resources and the maintenance and development of the farming community will constitute part of a national total plan for agriculture and the rural areas.

OPTIMUM DEVELOPMENT OF THE MARINE INDUSTRY

Optimum development of the marine industry depends on the optimum development of the marine resources. However, because the marine

resources are even more sensitive to over-exploitation than agricultural resources are, the emphasis should necessarily be placed on the protection of various resources from over-exploitation. The Minister of Agriculture and Fisheries is consequently directly responsible in the case of the majority of the marine resources for the determination of permissible levels of exploitation. The critical aspect here is the maintenance of the correct balance between exploitation and protection. On the one hand the resources should be fully utilised for the benefit of the Republic and its inhabitants, but on the other hand it is necessary to ensure that the level of utilisation can be sustained in order to maintain stability and enable future generations to utilise the resources as well.

The Department at present plays a less important part in the marketing of marine products and its involvement is confined mainly to arrangements for the provision of local needs for basic food products and raw materials and to control functions whose object is to control the exploitation of the resources. Single-channel marketing systems developed by the industry on their own initiative are permitted in view of the advantages they hold for the industry, but in these cases the Department looks after the interests of the local consumer as far as this is considered necessary.

Financing is also made available in the case of the marine industry, through the agency of the Fisheries Development Corporation of South Africa Limited, but the financing is at a far lower level, since funds for this purpose are very limited at present and consequently have to be reserved mainly for the smaller entrepreneur. The Department supports the marine industry indirectly, however, through research on resources, the provision of harbour facilities and control over entry to several sectors.

The legislation created for control over the marine resources and the promotion of the industry comprises -

- (a) the Sea Fisheries Act, No. 58 of 1973, which gives the Minister wide powers to control the exploitation of the marine resources, makes provision for the appointment of a Fisheries Advisory Council to advise him on these matters, and makes provision for the supervision of compliance with control measures;
- (b) The Fishing Industry Development Act, No. 86 of 1978, which makes provision for the promotion of the marine industry and authorises the continued existence of the Fisheries Development Corporation of South Africa, Limited, for this purpose, and also makes provision for control over the processing, marketing and export of fish; and
- (c) the Sea Birds and Seals Protection Act, No. 46 of 1973, which makes provision for the protection of sea birds and seals.

The determination of optimum but safe levels of exploitation and the introduction of other control measures depend on continuous, intensive

and mainly applied research. This is no easy task because research in the sea is expensive and difficult. Direct and exact surveys of the extent and properties of marine resources are impossible in most cases, so that levels of exploitation and other control measures have to be based on stock estimates and calculated maintainable yields. Because marine sources are very sensitive to changes in the environment and to over-exploitation, it is necessary that research techniques should be continually refined, the consequences of exploitation at a particular level should be continually monitored and the control measures adjusted where this appears necessary. The Department is responsible for seeing that the control measures are complied with, which is also a difficult task.

THE FUTURE

In view of South Africa's limited resources, the scarcity of the manpower to staff the agricultural and marine industries at a professional and technical level and the rapid population increase, it can be predicted that unprecedented demands will be made on the Department of Agriculture and Fisheries in the coming decade. Indeed, this decade may be decisive for South Africa's position as a supplier of food in Africa. Within this context the value of the agricultural and marine industries cannot be sufficiently emphasised and it is extremely important that the Department should have the organisation, funds and manpower necessary to ensure the optimum development of these two strategic industries.

2. Economic review

1. GENERAL

In 1980 the South African economy achieved a real growth rate of about 8 %. The rapid growth resulted mainly from a considerable increase in the real domestic demand. It was especially real private consumer spending that moved at a high level. The rate of increase in consumer and producer prices accelerated considerably in the second half of the year. In the case of agriculture the real contribution to the gross domestic product increased by about 13 % to R2 327 million in 1980.

The balance of payments showed a surplus of R2 845 million in the year under review. Although net gold production increased considerably in 1980 and goods exports also rose sharply, a smaller surplus on the current account was realised than in 1979 as a result of, amongst other things, a particularly sharp increase in goods imports. The value of agricultural exports amounted to about R1 787 million in 1981 as against R1 692 million in 1979.

2. THE CONTRIBUTION OF AGRICULTURE TO THE GROSS DOMESTIC PRODUCT

The contribution of agriculture to the gross domestic product over the past three years is shown in Table 1.

Agriculture's contribution to the gross domestic product, calculated at factor cost, increased by about 29 % in 1980, compared with 6 % the previous year.

Although the percentage contribution of agriculture to the gross domestic product dropped by about 0,8 % from 1978 to 1980, the contribution as such increased by 37 % during that period to R3 459 million.

TABLE 1 - Contribution of agriculture to the gross domestic product, 1978 - 1980

	Gross domestic product at factor cost	Contribution of agriculture to the GDP at factor cost	Percentage contribution of agriculture
	R million		%
1978	37 020	2 533	6,8
1979	43 726	2 675	6,1
1980	57 917	2 459	6,0

3. FARMERS' INCOME

The gross income of farmers for the year ended 31 December 1980 amounted to about

R5 631 million - an increase of 26 % above the R4 484 million of the previous year.

An analysis of the various farm enterprises shows that the gross income from field-crop production amounted to R2 478 million, as against R1 844 million during 1979. Production as well as producer prices of summer cereal crops increased.

The gross income from horticultural production increased by about R165 million to R959 million in 1980. In the case of citrus fruit the export payments decreased by about R16 million to R105 million. As regards deciduous fruit, the income amounted to about R233 million in 1980, compared with R173 million the previous year. In the case of vegetables the gross income amounted to R329 million.

During 1980 the gross income from animal husbandry production amounted to R2 194 million, an increase of 19 %. The value of commercial cattle and calf slaughterings for the period under review amounted to R651 million - an increase of 32 %. Prices of slaughter cattle rose by 28 %. The gross income from commercial sheep slaughterings is estimated at R200 million, as against R163 million the previous year. The producer prices of slaughter sheep and pigs were 21 % and 20 % higher respectively. The gross income from wool increased by R12 million to R184 million. Production of cheese was at a higher level, but that of butter was lower. Production of broilers increased by about 10 %.

The expected net income of farmers for 1980 is estimated at R2 255 million, compared with R1 560 million in 1979 - an increase of 45 %. The considerable increase in the net income can be ascribed mainly to bigger crops - maize, grain sorghum and groundnuts - and to an increase in producer prices.

Details of the quarterly net income over the past three years are shown in Table 2, while the net income of farmers over the past decade is shown in Table 1 of the Statistical Annexe.

TABLE 2 - Net income of farmers, 1978 - 1980

	1980	1979	1978	1980
	R million			%
January to March	143	72	97	199
April to June	1 290	869	814	148
July to September	383	229	371	167
October to December	439	390	249	113
Total	2 255	1 560	1 531	145

4. GROSS VALUE AND PHYSICAL VOLUME OF AGRI- CULTURAL PRODUCTION

The total gross value of agricultural production for 1980 is estimated at R5 925 million, which is about 25 % higher than for 1979. Details of the total gross value of agricultural production for the past three years are shown in Table 3, and the value of the individual products is given in Table 2 of the Statistical Annexe.

TABLE 3 - Gross value of agricultural production, 1978 - 1980

	1980	1979	1978
		R million	
Field crops	2 782	2 123	1 961
Horticulture	976	796	649
Animal husbandry	2 167	1 812	1 497
Total	2 925	4 731	4 107

The gross value of field-crop, horticultural and animal production increased by 31 %, 23 % and 20 % respectively as a result of an increase in both the volume of production and producer prices.

Production of summer cereals in particular showed an increase in 1980 compared with the previous year. The 1980 maize crop of 10,7 million tons was considerably bigger than the 8,3 million tons of the previous year. The wheat crop amounted to 1,5 million tons, which is considerably lower than the 2,1 million tons in 1979/80. Production of sugar-cane was 4 % higher than during the previous year and amounted to 18,6 million tons.

Production of deciduous fruit increased by 5 % from 1,9 million tons in 1979 to 2,0 million tons in 1980, while production of citrus fruit increased by 6 % to about 45,4 million containers of 15 kg, as against 42,8 million in 1979.

In the case of livestock, cattle slaughterings increased by about 5 %, while sheep slaughterings remained more or less constant. Production of wool declined by 2 % to 99,9 million kg in 1980. As regards dairy production, 31 000 tons of factory cheese and 17 400 tons of factory butter were produced in 1980, compared with 33 000 tons and 17 800 tons in 1979.

The volume of the total agricultural production was about 8 % higher in the past year in 1979. The volume indices of all agricultural products, with 1970 as base year, as well as those of field-crops and horticultural and animal products separately, for the past three years, are shown in Table 4. The relevant indices for the past decade appear in Table 3 of the Statistical Annexe.

Field crops

The volume of field-crop production increased 14,5 %. The volume indices of certain field crop products appear in Table 5.

TABLE 4 - Volume indices of agricultural production, 1978 - 1980

	1980	1979	1978
Field crops	153,0	133,6	150,6
Horticulture	151,4	135,7	131,6
Animal husbandry	122,7	123,4	117,9
All agricultural products	139,8	129,6	133,7

TABLE 5 - Volume indices of certain field crop products, 1978 - 1980

	1980	1979	1978
Maize	174,9	134,9	164,4
Grain sorghum	177,0	99,2	163,8
Groundnuts	114,7	60,1	100,0
Sunflower seed	338,0	321,0	453,0
Wheat	118,3	144,0	126,3
Sugar-cane	130,3	125,7	135,6
Tobacco	110,2	138,9	128,0
Total	153,0	133,6	150,6

The production of maize, grain sorghum, groundnuts, sunflower seed and sugar-cane was higher than during 1979. The sharpest increases were experienced in respect of groundnuts and grain sorghum, namely 91 % and 78 % respectively. The tobacco crop was 21 % smaller than during 1979, while 18 % less wheat was harvested than during 1979.

Horticulture

The volume index of horticultural products increased by about 12 %. With the exception of apricots the production of deciduous fruit was higher than during the previous year. The citrus crop was 6 % up on that of 1979, while 8 % more subtropical fruit was produced. The total vegetable production increased by 12 % while there was an increase of 14 % in the case of tomatoes.

TABLE 6 - Volume indices of certain horticultural products, 1978 - 1980

	1980	1979	1978
Apples	189,7	169,3	170,8
Pears	152,3	145,4	123,4
Wine grapes	189,7	171,0	164,5
Table grapes	134,2	127,0	99,3
Oranges	111,2	105,9	110,5
Tomatoes	134,5	117,6	118,9
Total	151,4	135,7	131,6

Animal husbandry

From the November 1980 estimate of livestock numbers on farms of Whites it appears that cattle numbers have dropped by 4 % and sheep numbers by 3 % during the past year. Pig numbers increased by 3 % while the numbers of goats remained constant. The volume indices in respect of certain animal products for the past three years are shown in Table 7.

TABLE 7 - Volume indices of animal products, 1978 - 1980

	1980	1979	1978
Slaughter stock			
Total slaughtered	133,6	138,7	124,9
Cattle and calves	166,6	174,6	153,1
Sheep and goats	82,1	81,7	76,1
Pigs	97,2	101,4	109,2
Wool	63,2	63,2	76,5
Mohair	141,9	125,6	104,7
Fresh milk	85,5	85,3	86,6
Dairy products	71,7	72,8	69,2
Poultry and poultry products	241,6	229,5	222,6
Total	122,7	123,4	117,9

During 1980 cattle and calf slaughterings were nearly 5 % less than in 1979. The supply of small stock remained virtually constant, while pig slaughterings dropped by 4 %. Wool production remained constant, but mohair production increased by 13 %.

5. PRODUCER PRICES OF AGRICULTURAL PRODUCTS

During 1980, producer prices of agricultural products showed a further upward trend. The combined price index of agricultural products rose by 17 %, compared with an increase of 19 % during the previous year. Price increases occurred in respect of all agricultural products.

The producer price indices for the past three years, with 1975 as base year, appear in Table 8, while those since 1975 are shown in Table 4 of the Statistical Annex.

TABLE 8 - Indices of producer prices of agricultural products, 1978 - 1980

	1980	1979	1978
Field crops	183,0	155,5	126,6
Horticulture	156,2	141,5	123,0
Animal husbandry	174,6	144,9	125,3
Combined	175,0	149,0	125,5

Field crop products

During 1980 the prices of field crop products rose by 18 %, compared with an increase of 23 % during the previous year. Maize prices were 17 % higher than in 1979, while the price of wheat rose by 22 %.

Horticultural products

The combined price index of horticultural products rose by 10 % during 1980, compared with an increase of 15 % during the previous season. The prices of vegetables rose by 17 % (40 % during the previous year). Fruit prices were 8 % higher than in 1979. The prices of deciduous fruit on the local market rose by 2 % during 1980, compared with an increase of 16 % the previous season, and those of subtropical fruit by 10 % (9 % the previous year).

Animal products

The producer prices of animal products rose by 20 % in 1980 as against an increase of 16 % in 1979. Wool and mohair dropped slightly by 0,4 %, compared with an increase of 10 % during 1979. Producer prices of all slaughter stock rose by 25 %. The prices of slaughter cattle and sheep rose by about 28 % and 21 % respectively and those of pigs by 20 %. The price of dairy products rose by 19 %.

6. FARMING REQUISITES

The combined price index of farming requisites for the past three years, with 1975 as base year, is shown in Table 9, while the indices for the past decade appear in Table 5 of the Statistical Annex.

The combined price index of farming requisites was about 16 % higher in 1980 than in 1979, compared with an increase of 21 % the previous year.

TABLE 9 - Price indices of farming requisites, 1978 - 1980

	1980	1979	1978
Short-term requisites	214,9	180,5	144,6
Machinery and implements	188,0	170,7	152,8
Fixed improvements	201,1	179,9	156,5
All farming requisites	207,4	178,3	147,9

Prices of short-term requisites

The prices of the most important short-term requisites over the past three years appear in Table 10.

TABLE 10 - Price indices of short-term requisites, 1978 - 1980

	1980	1979	1978
Fertiliser	186,7	159,3	140,3
Fuel	355,9	278,2	151,6
Stock feed	214,6	178,3	151,3
Packing material	168,0	146,8	130,9
Sprays and dips	137,0	124,2	120,5
Maintenance and repairs	185,6	167,3	150,3
Combined	214,9	180,5	144,6

By far the biggest increase in the prices of short-term requisites occurred in the case of fuel. The price increased by 28 %, but the increase was nevertheless much lower than the 84 % increase in 1979. After fuel prices, feed prices showed the biggest increase, namely 20 %.

Fertiliser and packing material were 17 % and 14 % more expensive respectively, while the prices of sprays and dips and maintenance and repairs rose by 10 % and 11 % respectively.

Prices of machinery and implements

The combined price indices of machinery and implements appear in Table 11.

The combined price index of machinery and equipment rose by 10 % from 1979 to 1980. The

TABLE 11 - Price indices of machinery and implements, 1978 - 1980

	1980	1979	1978
Tractors	189,7	176,2	162,7
Lorries	197,9	179,4	155,4
Implements	177,6	162,6	146,4
Irrigation equipment	186,5	156,9	135,8
Combined	188,0	170,7	152,8

biggest increase was experienced in respect of irrigation equipment, namely 19 %. On the other hand, tractor prices rose by only 8 %, while lorries and implements were 10 % and 9 % more expensive respectively.

Expenditure on short-term requisites

The expenditure on intermediate goods and services amounted to nearly R2 173 million during 1980, compared with R1 814 million in 1979 - an increase of 20 %. The increase is mainly due to price rises. Details of the expenditure on some of the most important items during 1980 and the percentage increases above those of the previous year are as follows:

	R million	%
Fuel	371	13
Maintenance and repair of machinery and implements	299	18
Fertilisers	482	27
Stock feed	504	26

7. INVESTMENT

The total value of the capital assets in agriculture on 31 December 1980 is estimated at R26 612 million. Land and fixed improvements represented 77 % and livestock 14 %.

The expenditure on fixed improvements and other capital goods amounted to R853 million in 1980, which is about 44 % higher than in the previous year. The increased investment can be ascribed mainly to a considerable increase in the demand for machinery, implements and vehicles.

Of the R299 million spent on fixed improvements, R124 million was in respect of dwellings. In the case of machinery, implements and vehicles, about R441 million was spent on machinery and implements and R113 million on vehicles. The change in the livestock inventory was caused by the drop in livestock numbers resulting from intensive marketing.

TABLE 12 - Annual investment in agriculture, 1978 - 1980

	1980	1979	1978
	R million		
Fixed improvements	299	256	223
Machinery, implements and vehicles	554	335	339
Change in the livestock inventory	- 47	- 56	+ 29

8. FARMERS' DEBT

The total farming debt rose by about 19 % during 1980 to R3 830 million. This increase can be ascribed mainly to the rise in prices of agricultural land and capital goods. An analysis of the various sources of financing shows that commercial banks, agricultural co-operatives and the Land Bank are the most important sources, accounting for R802 million, R867 million and R676 million respectively at the end of 1980. Financing by agricultural co-operatives and commercial banks increased by nearly 32 % and 16 % respectively during 1980.

9. LOCAL CONSUMPTION

Particulars of the *per capita* consumption of a number of food products over the past three years up to 1979 are given in Table 13.

TABLE 13 - *Per capita* consumption of a number of agricultural products, 1977 - 1979

	1979	1978	1977
	kg/capita/ year		
Red meat	33,97	33,96	32,04
Maize products	86,80	87,36	94,74
Wheat products	49,56	48,97	49,06
Sugar	38,51	39,33	40,33
Butter	0,62	0,70	0,86
Cheese	1,09	1,08	1,05

Consumer prices

The prices of consumer goods, especially food, showed a further increase during the past year. The combined consumer price index for 1980 is 14 % higher than in 1979. In 1980 food prices increased by 19 %, compared with an increase of 16 % the previous year.

As regards individual food items, meat prices rose by 32 % during 1980, compared with an increase of 17 % the previous year. The consumer had to pay about 11 % more for dairy products and eggs, 15 % more for grain products and 12 % more for fats, margarine and oils.

Vegetable prices rose by 17 % in 1980, while fruit prices showed an increase of 7 %. The prices of sugar and related products rose by 12 %.

The consumer price indices of a number of food items for the past three years are shown in Table 14.

Consumer spending

The sustained upward trend in food prices during 1980 contributed to the continuation of the increase in consumer spending on food. This amount came to R8 566 million for the past year. This is an increase of about 24 %, compared with an increase of about 22 % the previous year.

Larger amounts were spent on all items, but a significant increase occurred in the case of meat. As regards liquor and tobacco, increases of 10 % and

TABLE 14 - Consumer price indices of a number of foodstuffs, 1978 - 1980

	Weight %	1980	1979	1978
All items	100,0	176,7	155,3	137,2
All items, excluding food	75,0	174,3	155,0	138,2
Food	25,0	184,0	154,7	133,7
Meat	9,2	182,3	137,6	117,4
Dairy products and eggs	3,0	166,9	149,7	129,6
Cereal products	3,4	179,8	156,0	142,3
Vegetables	3,5	174,9	149,9	116,8
Fruit	1,4	170,1	159,6	137,6
Sugar and related products	0,5	252,7	225,1	195,9
Fish	0,9	195,2	177,3	149,5
Fats, margarine and oils	1,0	192,7	172,0	147,4

Source: Department of Statistics (Base : 1975 = 100)

12 % respectively were experienced during the past year, compared with increases of 18 % and 15 % respectively during the previous year. Particulars of consumer spending on food products for the past three years appear in Table 15.

TABLE 15 - Consumer spending on food, liquor and tobacco, 1978 - 1980

	1980	1979 R million	1978
Meat	2 394	1 892	1 514
Bread and cereal products	1 825	1 512	1 255
Vegetables and fruit	1 559	1 211	979
Milk, milk products and eggs	814	699	587
Sugar, preserved fruit and jam	632	533	443
Other food items	1 342	1 087	890
Total spending on food	8 566	6 934	5 668
Liquor	2 214	2 007	1 703
Tobacco	714	639	554
Total	11 494	9 580	7 925

10. EXPORT OF AGRICULTURAL PRODUCTS

The f.o.b. value of unprocessed and partially processed agricultural products that were exported in 1980 amounted to R1 787 million, compared with R1 692 million in 1979.

Present indications are that the total export earnings of agricultural products will amount to approximately R1 895 million in 1981. These higher earnings can be ascribed to the larger quantities of maize and maize products and citrus fruit that are expected to be exported.

The volume of agricultural products exported rose by about 9 % during 1980. As regards processed agricultural products, the volume index shows a drop of 9 %. There were drops of 8 % and 19 % respectively in respect of horticultural and animal products and an increase of 4 % in the case of field crop products. There was an increase of 22 % in the volume index of unprocessed agricultural products. The unit prices of unprocessed agricultural products rose by about 2 % during 1980, while those of processed agricultural products rose by 40 %.

In 1980 maize and maize products (R423 million) and sugar (R387 million) were the biggest agricultural exports, followed by fresh fruit (R229 million), wool (R220 million) and canned fruit (R97 million).

Details of the total exports of agricultural products during the past three years, compared with all export items (excluding bullion gold), are shown in Table 16.

TABLE 16 - Value of exports, 1978 - 1980

	1980	1979 R million	1978
Total (excluding gold)	9 717	9 471	7 333
Total - unprocessed agricultural products	987	826	776
Total - all agricultural products	1 787	1 692	1 544
Agriculture as percentage of total	(18 %)	(18 %)	(21 %)

As far as short-term prospects are concerned, it is expected that about the same amount of wool will be exported in 1981. More maize and maize products will, however, be exported but less sugar. World prices of karakul pelts and hides and skins are moving at a considerably lower level than during the previous year, while canned fruit is experiencing sharp competition on the export market. The price realised for maize on the overseas market is still moving at a low level.

Details of the most important agricultural products exported and imported during the past 10 years appear in Table 7 of the Statistical Annexe.

3. Marketing of agricultural products

SCHEMES

At present there are 21 agricultural control boards, which marketed about 76 % of agricultural production in 1980 - on the basis of the gross value - under their control schemes. Almost 9 % of agricultural production on the basis of gross value was marketed in terms of other legislation, and no control was exercised over the marketing of 15 %. Further particulars of the percentage proportions are given in Table 1.

TABLE 1 - Percentage composition of the gross value of agricultural production, 1980

Scheme/product	%
1. Schemes in terms of the Marketing Act	
(a) Single-channel fixed-price schemes	
Maize	21,98
Winter cereals	6,25
Industrial milk and butterfat	2,38
(b) Single-channel pool schemes	
Oilseeds (groundnuts, sunflower seed and soya beans)	3,11
Leaf tobacco	1,46
Chicory	0,02
Buckwheat	0,01
Lucerne seed	0,02
Deciduous fruit	3,50
Citrus fruit	1,96
Dried fruit	0,72
Bananas	0,38
Rooibos tea	0,03
Fresh milk and cream	3,79
Wool	3,10
Mohair	0,61
(c) Surplus disposal schemes	
Grain sorghum	1,24
Dry beans	0,88
Potatoes	2,16
Slaughter stock	18,41
Eggs	1,56
(d) Supervisory and price-regulatory schemes	
Canning apricots, peaches and pears	0,24
Cotton	1,45
(e) Sales promotion schemes	
Karakul pelts	0,39
Subtotal	75,65
2. Control in terms of other legislation	
Sugar	5,31
Lucerne hay	1,34
Wattle bark	0,21
Wine	1,92
Ostrich products	0,18
Subtotal	8,96
3. Uncontrolled products	15,39
Grand total	100,00

ADMINISTRATION OF THE ACT

NEW SCHEMES

No new schemes were instituted during the period under review.

AMENDMENT OF SCHEMES

In accordance with amendments to the Marketing Act (Act 69 of 1968) at the beginning of 1980, the schemes of the existing 21 control boards, with the exception of the oilseeds control scheme, were amended in order to adapt them to the amended Marketing Act. The penalties prescribed in the schemes were adapted and amendments were introduced so that the Minister, instead of appointing a member of a control board for a fixed term of three years, can appoint him for any period he determines, but for not more than three years. A further amendment was the authority granted to control boards to provide financial assistance from own funds to committees or organisations of the South African Agricultural Union and of agricultural organisations established to promote some branch of the agricultural industry and affiliated to the Union. These schemes were also amended so that, in addition to agency conditions, the Minister has now also to approve the purposes for which the control boards may appoint agents.

The deciduous fruit, citrus and banana schemes were amended to give these three control boards the power to recover losses suffered by a pool from producers, without Ministerial approval, if the deliveries of such producers to the control board concerned differ from the quantities they undertook to deliver and the losses suffered by the pools can be ascribed to such action by the producers concerned.

In addition to the above amendments to schemes, the following schemes were amended as follows:

The deciduous fruit scheme was amended in order to give the Deciduous Fruit Board the power to increase or reduce pool payments to producers if the quality of the fruit delivered to the Board by them is above or below the average for the industry. The scheme was also amended to raise the membership of the Peach and Plum Advisory Committees to not more than 8 and 10 members respectively. The scheme was further amended by the making of provision for the introduction of a Plum Estimating Advisory Committee.

The rooibos tea control scheme was amended by the inclusion of the Magisterial Districts of Ceres, Hopefield, Malmesbury, Wellington, Tulbagh and Paarl in the "controlled area".

The canning fruit scheme was amended in order to give the Canning Fruit Board the power to prohibit producers from selling canning fruit except in terms of a permit issued by the control board.

The lucerne seed scheme was amended to enable the Lucerne Seed Board to grant exemption to producers from the control board's single-channel embargo in cases involving lucerne seed that fall under the Plant Breeders' Rights Act.

The mohair scheme was amended to give the control board the opportunity to purchase mohair from the pools.

The wool scheme was amended to make provision for an advisory committee for shearing services to advise the Wool Board on the provision of funds from the General Fund for a comprehensive research project on shearing services.

The diary control scheme was amended to make control over fresh milk applicable in Natal as well. A further amendment to the scheme makes provision for the registration of industrial milk depots and for a distributor to receive milk from two separately controlled areas at one reception point.

The egg control scheme was amended to extend the control the Egg Board exercises in Natal, the Eastern Cape, the Western Cape and the Transvaal and to extend the existing control in the municipal areas of Pietersburg and Newcastle to the districts of these towns.

The meat scheme was amended to make provision for a Distribution Advisory Committee to replace the Consumer Advisory Committee, with the object of advising the control board on the distribution of meat, the stimulation of the demand for meat and meat products and the preservation, processing, manufacturing, storage or marketing of meat and meat products.

With regard to tobacco, a new grading system for flue-cured tobacco was introduced; it makes provision for 65 grades, as against 32 grades in the previous series. The new grading system makes a substantial distinction between the more desirable open grain and the less desirable closed grain tobacco.

INVESTIGATIONS

Cost investigations

With a view to determining the

remunerations which control boards pay their agents for services rendered, and in order to establish boards of control to fix margins for the processing of agricultural products, the following cost surveys were undertaken by the Investigations Division during the period under review:

1. A survey of the handling and storage costs (bagged and in bulk) of summer and winter cereals, oilseeds and dry beans borne by agricultural co-operatives.
2. An investigation into the costs involved in the shelling and sorting of groundnuts by agents of the Oilseeds Control Board.
3. A survey of the costs attached to the handling, storage and cleaning of lucerne seed by co-operative agents of the Lucerne Seed Control Board.
4. A survey of the costs attached to the handling, storage and sale of wool by Boeremakelaars (Koöperatief) Beperk, which acts as sole agent for the Wool Board.
5. A complete survey of the milling costs of wheat at the major flour mills.
6. A comprehensive survey of the costs attached to the baking of white, brown, whole-wheat and compound bread at a sample of bakeries.
7. A supplementary survey of the costs involved in the preparation and marketing of recently flayed hides and skins in the more important urban centres.
8. An investigation into the production costs of fishmeal in the Republic and South-West Africa.
9. An investigation into the profitability of canning clingstone peaches, Bon Chrétien pears and apricots.
10. An investigation into the profitability of the manufacture of citrus juices and the canning of grapefruit segments at specific factories.

The last two investigations were intended to bring the control boards concerned up to date on the profitability of the processing of their products with a view to the fixing of producer prices.

Other investigations

The Marketing Council investigated and reported on a proposed amendment of the dried fruit scheme to include dehydrated vegetables. After considering the Marketing Board's report the Minister rejected the proposed amendment.

4. Abattoir matters

In accordance with the policy that all abattoirs must comply, by the end of 1984, with the requirements of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), which is administered by the Division of Veterinary Services, the Abattoir Commission, in terms of the Abattoir Industry Act, 1976 (Act 54 of 1976), concerned itself mainly with the evaluation of applications for the building and renovation of abattoirs during the year under review. During its 10 meetings, the Commission dealt with 41 applications for the erection of new abattoirs and 46 applications for permission to effect improvements to existing abattoirs. The subject of most applications was the erection and improvement of small abattoirs, which indicates that most of the major projects are already at the planning and building stage or have been completed.

Factors that may be considered of decisive importance in the consideration of applications include:

- capacity and throughput, i.e. whether the abattoir provided will be of economic size and to what extent it will be utilised;
- the chances of centralisation in cases where units of uneconomic size are under consideration were the distance from and the possibility of integration with an existing abattoir are naturally strong considerations;
- the availability of slaughter animals in view of the riskiness of the enterprise in areas where the supply of slaughter animals is inadequate and in view of the fact that it is usually more economic to supply meat to such areas;
- the availability of a suitable site, the cost of providing services, and the unit tariffs that are levied; and
- trade considerations and practices.

The cost structure, but especially the cost of labour, services and loans, rose sharply during the year under review. Unlike the preceding years, this year saw a decline in throughput owing, amongst other things, to a drop in the slaughter of cattle, combined with a steady increase in the transportation of meat, especially from the controlled area to the outlying areas. Owing to increased expenditure coupled with a decrease in throughput more owners of public service abattoirs experienced financial problems. The number of applications for tariff adjustments consequently increased from 107 during the preceding year to 142 this year.

This policy is that tariffs are determined on a no-profit-no-loss basis. An increasing number of abattoir owners, however, are insisting on higher tariffs than can be justified on a cost basis in order to make provision for building up funds to meet

the cost of replacements and exceptional maintenance. This also applies to abattoir owners who are in the process of building and improving, the aim being to avoid excessively large tariff adjustments when the new and improved abattoirs are commissioned. The building-up of funds for the above aims is encouraged and abattoir owners are required to keep a closed abattoir reserve account.

Numerous owners of new abattoirs experience financial problems despite the above-mentioned tariff policy. In cases where owners of abattoirs have to compete with facilities that do not comply with the structural requirements and where meat inspection is not even undertaken, the relatively high tariffs are the reason for the financial problems since the trade does not make use of the abattoirs of the owners referred to but slaughters at other places and then brings the meat into the areas of jurisdiction of such owners. The demand that restrictions be placed on the trade to compel its members to make use of locally available facilities, and that protective tariffs be introduced intensified during the year under review. Physical restrictions on the source of supplies are scarcely enforceable in practice, owing to the widely divergent circumstances and the complex marketing set-up. Protective tariffs provide limited possibilities of remedying the situation but the drawback is that such tariffs place an additional burden on the industry, that inefficiency may become entrenched and that protective tariffs may cause unbalanced development within the industry. The alternative that offers the best chance of combating the problem is the acceleration of the process of elimination of abattoirs which, structurally, do not comply with the requirements and which cannot be operated in accordance with them. The buying-out and closing of abattoirs in cases where facilities for integration are available should also receive serious attention. In this regard the desirability of compulsory meat inspection, in view of the problems of human and animal disease, and the economic implications for the beef industry can hardly be overemphasised.

With the closest co-operation and support of interested persons and bodies, especially the Division of Veterinary Services, with its regional organisations, the S.A. Abattoir Corporation and the Meat Board, the Commission proceeded with its efforts to promote efficiency in the management and operation of abattoirs. Operating costs are being reduced by, *inter alia*, the more general application of single control and the organising of a more even supply each day of the week. In the calculation of unit costs and evaluation according to norms continuous attention is paid to matters such as the inefficient use of labour and the unjustifiably high expenditure on water and power. The Commission is of the opinion that, through its

efforts and as a result of present circumstances, abattoir owners are gradually becoming more cost-conscious. In this connection it wishes to acknowledge the close co-operation and whole-hearted support received from abattoir owners.

The cost of destroying rejected material is rising sharply, and increasing quantities of blood are placing a heavy burden on sewage works. Progress is being made with the central processing of these substances, which would otherwise not be justifiable on economic grounds and, judging by price trends, the demand for bloodmeal, tankage and fat is increasing. With the co-operation of the S.A. Abattoir Corporation a beginning was made during the year under review with a project aimed at assisting abattoir owners in the outlying areas to increase the efficiency of reclamation of raw material and the manufacture of by-products.

Steps to combat slaughtering damage are being considered, in consultation with the Meat Board. Much has still to be done in this connection.

For a long time now the Commission has been experiencing a serious need for type plans with specifications for buildings and equipment, in

order to curtail the erection costs of smaller abattoirs and speed up to submission of tenders and the evaluation of plans. During the past few years consideration has been given to a variety of ways of effecting this and the stage has now been reached where sets of type plans ought to be available within the near future.

Complete sets of plans, specifications, bills of quantities, etc. will be issued to organisations/persons who have ministerial approval for the erection of new abattoirs of the relevant grade. The plans will be for sale to prospective abattoir owners and all other organisations/persons who require more than one set.

Lay-out plans, that is, plans which depict the basic lay-out of each grade of abattoir, will be made available free of charge on request to interested persons. The reason for making the lay-out plans freely available is that the plans are aimed at increasing efficiency within the industry.

With a view to closer liaison with interested persons and bodies, 74 abattoirs were visited during the year under review and discussions were held on matters of common interest.

5. Fresh produce market matters

INTRODUCTION

In order to promote and extend orderly marketing and stability in the fresh produce industry, the Commission for Fresh Produce Markets continued, during the year under review, to improve, co-ordinate and rationalise the activities connected with fresh produce markets. In this respect, in co-operation with market authorities, market managements and agricultural unions, particular attention was given to the provision, expansion and improvement of adequate and functional market facilities, to the efficient operation and management of markets and to communication between all the interested persons and bodies, such as market managements, market agents, producers, consumers, and the fruit and vegetable trade.

With this aim in view, the Commission paid visits to all the national fresh produce markets and held discussions with market authorities, market managements and market agents. In addition the Commission attended various meetings of agricultural unions and wherever possible advice was given on the marketing of fresh fruit and vegetables at fresh produce markets.

In the course of the year the Commission held 10 meetings in Pretoria. Altogether 34 meetings of market advisory committees in the 14 centres where national fresh produce markets have been established were attended in an advisory capacity. As in the past the various market advisory committees gave market authorities valuable advice concerning matters connected with their markets.

PLANNING AND ESTABLISHMENT OF NEW MARKETS

Of the 12 centres where national fresh produce markets have been established, all but Springs and Welkom have modern and functional market facilities. The extensions to the Springs and Uitenhage markets were completed during the past year and both markets now have 100 % more floor space than previously. New refrigeration facilities have been installed and put into service at the Springs market.

The Welkom City Council has already taken active steps to build a new market.

The extensions to the Pretoria market have reached an advanced stage and when completed the market will have an area of 40 000 m², which will make it the largest market under one roof in Southern Africa. Cape Town's City Council is planning to start on considerable extensions to the Cape Town market before long; the Klerksdorp City Council has already started on considerable

extensions to the refrigeration and ripening facilities of the city's market.

For the first time since the commencement in 1971 of the Commission for Fresh Produce Markets Act, 1970 (Act 82 of 1970), approval was given, as a result of exceptional circumstances, to a private organisation to establish a fresh produce market. Apart from this market at Phoenix, Durban, approval was also granted to the Municipality of Louis Trichardt for the building of a fresh produce market.

FINANCIAL ASSISTANCE

From 1971, when financial assistance was first given to market authorities, to 31 March 1981, an amount of R6 746 153 was granted to 11 market authorities that established new national fresh produce markets.

Table 1 shows the amounts allocated to each of the 11 market authorities.

TABLE 1 - Amounts allocated to market authorities of national fresh produce markets, 1971-1981

	R
Cape Town	213 673
Pretoria	189 244
Kimberley	32 975
Uitenhage	5 430
Pietermaritzburg	644 853
Johannesburg	2 266 313
Durban	1 753 368
Port Elizabeth	809 607
Vereeniging	502 578
Klerksdorp	126 260
East London	201 852
Total	6 746 153

During the year the Commission gave urgent attention to the possibility of affording further financial assistance to markets that had already received the maximum financial assistance but were still showing losses. Representations were consequently submitted to the Cabinet, which approved the provision of financial assistance up to a maximum of 25 % of the capital costs of a market to markets that show losses, subject to certain conditions.

MARKET INVESTIGATIONS

Although the Commission, where and when circumstances warrant it, conducts investigations at national fresh produce markets under section 3 of the Commission for Fresh Produce Markets Act, no such investigations were undertaken during the period under review.

TABLE 2 - Turnover and mass handled at the 14 national fresh produce markets, 1979 and 1980

Market	1980		1979		% increase/decrease	
	Turnover R1 000	Mass 1 000 t	Turnover R1 000	Mass 1 000 t	Turnover	Mass
Johannesburg	92 825	484,6	75 403	455,2	+ 23	+ 6
Cape Town	55 740	302,2	45 729	290,0	+ 22	+ 4
Pretoria	53 598	286,1	42 912	266,7	+ 25	+ 7
Durban	35 685	179,3	29 561	176,9	+ 21	+ 1
Pietermaritzburg	12 975	72,5	10 063	63,5	+ 29	+ 14
Port Elizabeth	11 978	76,6	9 750	68,3	+ 23	+ 12
Bloemfontein	9 702	54,1	6 912	45,9	+ 40	+ 18
Vereeniging	6 767	39,2	5 073	34,9	+ 33	+ 12
Klerksdorp	6 617	36,3	5 162	35,1	+ 28	+ 3
East London	6 419	32,4	4 966	29,2	+ 29	+ 11
Springs	6 358	36,4	4 934	33,1	+ 29	+ 10
Kimberley	4 870	25,7	4 375	27,2	+ 11	- 6
Uitenhage	3 659	23,3	2 816	20,7	+ 30	+ 13
Welkom	2 749	14,8	2 319	13,6	+ 19	+ 9
Total	309 942	1 663,5	249 975	1 560,3	+ 24	+ 7

TABLE 3 - Turnover and mass handled at the seven larger non-national fresh produce markets, 1979 and 1980

Market	1980		1979		% increase/decrease	
	Turnover R1 000	Mass 1 000 t	Turnover R1 000	Mass 1 000 t	Turnover	Mass
Witbank	2 487	14,5	2 294	14,5	+ 8	-
Brakpan	943	5,7	866	6,2	+ 9	- 8
King William's Town	658	4,7	699	5,9	- 6	- 20
Kroonstad	445	3,2	422	3,5	+ 5	- 8
Grahamstad	366	2,7	387	3,0	- 5	- 10
Queenstown	308	3,5	273	3,4	+ 13	+ 3
De Aar	252	1,3	164	1,0	+ 54	+ 30
Total	5 459	35,6	5 105	37,5	+ 7	- 5

TURNOVER AT MARKETS

In 1980 the turnover at the 14 national fresh produce markets amounted to R309,942 million, compared with R249,975 million in 1979; this represents an increase of 24 %.

The total turnover of the seven larger non-national fresh produce markets for 1980 was R5,459 million, as against R5,105 million for the previous year - an increase of 7 %.

A total of 1,663 million tons of vegetables and fruit was handled on the 14 national fresh produce markets, compared with 1,560 million tons in 1979

- an increase of 7 %. The average value per ton rose from R160,21 in 1979 to R186,32 in 1980, which amounts to an increase of 16 %.

The total mass handled on the seven larger non-national markets dropped by 5 %, from 37 500 tons in 1979 to 35 600 tons during 1980.

Details of the turnover at the 14 national fresh produce markets and the mass handled during the past two calendar years are given in Table 2, and those of the seven larger non-national markets in Table 3.

6. Marketing research

STATISTICAL RESEARCH AND CALCULATIONS

Statistical research is continued on an on-going basis with the aim of obtaining a better picture of developments in the field of agricultural economics. The fields of research are the following:

- (a) Calculation of agriculture's contribution to the national economy
- (b) Determination of agricultural-economic trends
- (c) Estimation of the expected crops and livestock production

During the period under review, efforts were made in these three fields to make available more comprehensive and more reliable statistics in good time. Good progress was made with the revision of statistical series in which the 1975 calendar year is used as a base as against the existing indices with 1970 as base. Owing to the more detailed analyses being undertaken, contributions by the various control boards, private concerns and producers are being relied on to an increasing extent. Information concerning the projects discussed below is obtainable on request from the Division of Agricultural Marketing Research, Private Bag X246, Pretoria, 0001.

1. AGRICULTURE'S CONTRIBUTION TO THE NATIONAL ECONOMY

(a) Gross value of agricultural production

The gross value of agricultural production represents the total value of agricultural production calculated at farm prices. The gross values of the most important products are available separately on a seasonal as well as a calendar year basis.

(b) Production account

The production account is a monetary exposition of the production process in agriculture. This account was kept for both agriculture and forestry. The calculation of the added value of agriculture is now being carried out on a continuous quarterly, seasonal, and calendar year basis for the Republic and South-West Africa.

(c) Investment in agriculture

Gross investment in agriculture is the additional amount which is invested annually in capital goods such as fixed improvements, machinery and livestock. The balance, after allowing for depreciation, represents the net investment. Estimates of gross and net investment are made on a quarterly and calendar year basis.

During the period under review, this series was improved considerably owing to more recent agricultural census figures having become available.

The total capital investment in land, fixed improvements, machinery and livestock is calculated on an annual basis for the Republic of South Africa and for South-West Africa.

(d) Forestry account

The gross value of forestry production is updated on a quarterly and yearly basis. The calculations differentiate between the various kinds of timber, as well as between production on State plantations and production on private plantations.

(e) Agricultural production in the national states

The gross value of agricultural and forestry production is calculated and estimates of farming expenses and changes in the livestock inventory are made. The contributions of agriculture and forestry to the gross domestic product are determined and a distinction is made between subsistence production and production for marketing purposes.

(f) Farmers' debt

These calculations are undertaken half-yearly and contain information in respect of the total amount of farmers' outstanding debt, according to the source of financing.

(g) Calculations at constant prices for the Republic and South-West Africa

These calculations concern the contribution of agriculture to the gross domestic product at constant prices. The series was calculated at 1975 prices. Calculations are also made to eliminate the influence of seasonal fluctuations in respect of the Republic of South Africa.

(h) Agriculture's contribution on a regional basis

Calculations are made of the agricultural sector's contribution to the country's economy according to magisterial districts and agricultural regions. Data up to 1975 are now available and calculations in respect of 1976 are at an advanced stage.

(i) Consumer spending on food

Consumer spending on food represents the amount spent on food, liquor and tobacco. Estimates of consumer spending on food are available on a quarterly basis.

2. AGRICULTURAL ECONOMIC TRENDS

(a) Volume of agricultural production

To determine the annual change in the physical production and production trends over the years, indices were compiled of the volume of agricultural production. Indices of the volume of production of individual agricultural products, groups of products such as field husbandry, animal husbandry and horticultural products were drawn up, as well as a combined index for all products. The compilation of an index with 1970 as base was completed.

(b) Volume of agricultural products exported

The indices of the volume of agricultural products that were exported reflect the annual changes in amounts exported, as well as trends over the years. Apart from the combined index, separate indices were also compiled of the volume of unprocessed and processed agricultural products which were exported, as well as for individual products and groups of products. The indices were calculated according to the Laspeyres and Paasche methods. Indices according to the first-mentioned method are available for the period 1948 to 1979 and those according to the latter method for the period 1958 to 1979.

(c) Price indices

(i) Producer prices

Indices showing the producer price trends were compiled on a monthly and annual basis for individual products and groups of products, as well as for all agricultural products combined. The placing of this index on the 1975 base was completed.

(ii) Farming requisites

This index reflects the price trends of farming requisites. It is compiled on a quarterly basis and includes capital goods such as machinery, implements and material for fixed improvements, as well as intermediate goods such as fertiliser and fuel. The placing of the index on the 1975 base has now been completed.

(iii) Unit value of agricultural products exported

The index of the unit value of agricultural products that were exported reflects the changes in value from year to year, as well as over the years. In this case, too, the index is calculated by the Laspeyres and the Paasche methods and separate indices for processed and unprocessed products are also compiled. These indices are available up to 1980.

(iv) Land-price index

The land-price index is based on transfers of rural fixed property in the summer rainfall, winter rainfall, cattle and sheep grazing and Natal regions. This statistical series based on 1970 is available up to 1978.

(d) Stock-feed statistics

The collection, processing and analysis of data in respect of the production, consumption, supplies, imports and exports of stock feed continued. The data are available on both a quarterly and an annual basis.

(e) Production cost changes

During the period under review cost adjustments were again made in respect of maize and wheat in order to determine changes in their production costs. All these calculations are made with the aid of price indices and of information obtained during field surveys on the Transvaal Highveld and in the North-Western Free State and the Western Transvaal in respect of maize, and in the Swartland and Rûens regions and the Eastern Free State in the case of wheat.

During the period under review, production cost adjustments were made for tobacco and for canning peaches, apricots and pears. In these cost adjustments no provision was made for changes in yield per hectare as was done in the case of maize and wheat. Cost adjustments were also made for groundnuts, sunflower seed and soya beans.

(f) Calculation of the margin between farm prices and consumer prices of food, based on a South African food basket

In the course of the year the calculation on a monthly basis of the producer share in the consumer costs of the food basket was continued. This information is available up to April 1981.

3. CROP AND STOCK ESTIMATES

Estimates in respect of certain agricultural activities are made on a continuous basis. The most important aim of these forecasts is to give policy-makers and decision-makers in both the public and private sectors an early indication of expected agricultural production. Government departments, agricultural organisations, agricultural control boards and commerce and industry make ample use of these estimates.

The forecasting service depends on the voluntary co-operation of a number of producers who regularly provide details of the condition and expected size of their crops, livestock numbers and their production of animal products.

During the period under review estimates were made in respect of the following:

- (a) The production of summer grain (maize, grain sorghum, groundnuts, sunflower seed, soya beans, dry beans and buckwheat)

- (b) The production of winter grain (wheat, oats, barley, rye and lupins)
- (c) Cattle, sheep, goat and pig numbers
- (d) Wool production

In the case of cattle an estimate is made of the total herd as well as of its composition. As regards sheep, an estimate is made of both the total herd and the number of Karakul, Merino and other woolled and non-woolled sheep.

MARKETING

Normally numerous studies are undertaken from a marketing point of view on the structure of certain agricultural industries and on whether or not there is economic justification for certain practices. The purpose of this research is to contribute to the orderly and efficient marketing of agricultural products. Owing to the serious personnel shortage during the year under review, work in this direction was on a limited scale and only two studies were undertaken and completed, namely an investigation into the structure of the lucern industry and one into the source of agricultural products produced and consumed in the Pretoria/Witwatersrand area. For the rest an investigation was undertaken on behalf of the Abattoir Commission into the supply of cattle and meat to Rustenburg and the marketing of meat in Rustenburg and vicinity. No financial analyses were made or investigations conducted on behalf of the Commission for Fresh Produce Markets, and a request to investigate the establishment of a new market could not be complied with.

Regarding overseas marketing the Department continued to deal with documents received from and business in connection with international organisations such as GATT, UNCTAD, the International Wheat Council, the International Wool Study Group, the International Coffee Organisation and the International Olive Oil Council.

In addition to tariff cuts, the recent Tokyo round of the Trade Negotiations in terms of GATT resulted in multilateral agreements or codes being drawn up in respect of matters such as subsidies and countervailing duties, technical trade barriers, import licensing, customs values and anti-dumping measures. An International Arrangement regarding Bovine Meat, as well as an International Dairy Arrangement with separate protocols in respect of

milk powders, butter and cheese, was established. The codes or agreements also have a bearing on agriculture and are of a complex nature. Their implementation requires constant supervision and interpretation, and our representatives were continuously supplied with trade information, statistics and directives in respect of the International Meat Council and the International Dairy Products Council.

Documents from the International Wheat Council, as well as directives to the Department's representative on this Council, also received continuous attention.

The import regulations, arrangements and regulations of the EEC, which cover an extremely wide field, were studied and evaluated continuously in order to update information, make representations and advise the Department and agricultural organisations, and issue directives to the Department's overseas representatives.

The activities of the Department's representatives in the field of Agricultural Economics in Washington, London, Bonn, Brussels and Paris were supervised and reports, communiques and documents from these sources were dealt with and distributed by the Division.

The systematic collection and processing of export statistics, the updating of information about agriculture in overseas countries and the answering of innumerable domestic and overseas enquiries concerning the agricultural sector also proceeded.

The Division is represented on the Export Incentive Committee and is responsible for dealing with any matters concerning the agricultural sector which may arise. The Division is also represented on the Advisory Committee for Air Transport of Perishable Produce and deals with any business that arises. In addition, meetings in connection with various bilateral trade agreements, the Customs Union Agreement with Botswana, Lesotho and Swaziland and the economic co-operation agreements with Venda, Transkei and Bophuthatswana were attended.

Apart from publications that are used as media for the distribution of information, agricultural economic information that becomes available, including crop and livestock estimates, is also broadcast in the programme "Calling All Farmers".

Regular Publications and Market Information

Publication	Frequency	Nature of content
1. Crops and Markets	Monthly	Sales on the most important fresh produce markets, as well as statistical surveys regarding the economy of the agricultural sector
2. Abstract of Agricultural Statistics	Annually (January)	Comprehensive agricultural-economic statistics
3. Trends in the Agricultural Sector	Six-monthly (February and August)	A concise survey of the latest developments in the agricultural sector and in its various industries
4. Statistics on Fresh Produce Markets	Annually	An exposition of the mass, value and price per unit in respect of vegetables and fruit sold on the 14 national fresh produce markets, with comparative figures for the previous year
5. Agrekon (Departmental publication)	Quarterly (January, April, July and October)	Articles in connection with agricultural-economics

7. Production economics

The Division of Agricultural Production Economics is responsible for research in respect of the economics of agricultural production. This entails mainly research in respect of macro resource economics and farm business economics.

The activities of the Division during the period under review are merely mentioned below, no details being supplied.

RESEARCH

1. The acquisition of control over the right of use of resources and related matters

To a greater or lesser extent research was conducted in respect of the following:

- The determination of land values in the RSA;
- electrical power on farms;
- hiring and leasing of agricultural land;
- an efficiency evaluation of absentee owners in the North-Western Transvaal Bushveld;
- financial norms for extensive cattle farming in the Northern and North-Western Transvaal Bushveld;
- an efficiency evaluation of part-time farming that is conducted as an interim measure before starting to farm on a full-time basis.

Research in these fields is considered particularly important owing to the fact that farming has become virtually a closed profession which can be practised only by those who inherited land or who have made or are still making their fortunes elsewhere, and the implications of such a situation has for a healthy and efficient agricultural industry in South Africa.

2. The determination of minimum and maximum sizes of farming units

During the year under review attention was given to -

- the calculation of site sizes with a view to the laying out and development of irrigation schemes;
- the calculation of the subsistence levels of farms for the purposes of subdivision and financing;
- guidelines for the planning of an economically feasible irrigation farming enterprise.

South Africa's irrigation potential is limited and expensive to develop. Careful and correct planning during the development of irrigation schemes is therefore essential in order to ensure their optimum utilisation. The establishment of a scientific method and the calculation of reliable norms for determining the minimum viable farming units for purposes of subdivision (Subdivision of Agricultural Land Act) and financing (Agricultural

Credit Board) must also necessarily receive high priority.

3. Operating and production costs surveys

A compulsory full production costs survey that has to be undertaken annually on a rotating basis in one of the three most important maize producing areas - the Western Transvaal, the North-Western Free State and the Eastern Transvaal Highveld - with supplementary surveys in the two remaining areas, as well as the compulsory full production costs survey that has to be undertaken annually on a rotating basis in one of the three most important wheat producing areas - the Swartland, Rûens and the Eastern Free State - with supplementary surveys in the two remaining areas, was undertaken. In addition, the production costs of various other products were calculated, including those of sunflower seed, groundnuts and certain kinds of deciduous fruit.

4. Research on production factors

During the period under review a beginning was made with two investigations in this connection, namely:

- (1) Labour utilisation in the Oriental tobacco industry in the Western Cape.
- (2) The determination of a just remuneration for the management function in agricultural enterprises.

5. Adaptation of farm book-keeping systems to various types of farming

Two types of record systems are involved here, namely:

- (1) A conventional record-book for farmers, which is being developed;
- (2) a multi-phase mail-in record system, which will replace the existing comprehensive mail-in record system.

During the year a conventional record-book reached the stage of completion where it can be tested on a large scale. Work in respect of a new mail-in record system, known as the AGRIREP system, has made good progress. TRANSAPLAN I has already been implemented and 168 farmers are involved; TRANSAPLAN II is virtually ready for programming.

6. Farm business management with mail-in records as source data

This is a continuous project which has been in progress for about 15 years. The numbers of mail-in record collaborators who received analyses of their farming during the year under review, with

numbers for the previous year in brackets, are as follows:

Division of Agricultural Production Economics collaborators: 1 011 (1 081), divided into 170 study groups. Collaborators who were involved through co-operatives and whose records were analysed by the Division of Agricultural Production Economics: 253 (200). Valuable information has already been obtained from this project, not only for individual farmers, study groups and extension purposes but also for monitoring the state of the financial position of farmers over a period. Regular publications on the matter are made available.

7. Income and cost estimates

Cost estimates in respect of implements, vehicles and improvements and income and cost estimates in respect of branches of farming that are practised in specific areas or on specific types of land are proving to be extremely valuable aids in providing farmers and other interested persons with information.

In addition to an implement cost guide which is published annually, 182 income and cost estimates in respect of various branches of farming in specific areas were adjusted or newly compiled during the year under review.

TRAINING AND EXTENSION

Although the Division of Agricultural Production Economics is, strictly speaking, only a

research institution and is therefore not responsible for training and extension, it has not been possible up to the present to fill posts created on the establishment of the regional organisations of the Directorate of Agricultural Technical Services. The Division of Agricultural Production Economics is therefore compelled to provide training and extension to the best of its ability.

A total of 658 lectures of 40 minutes each and 167 practical classes of 2 hours each were given by the Division of Agricultural Production Economics at the five colleges of agriculture, namely Elsenburg, Grootfontein, Glen, Potchefstroom and Cedara.

Extension has necessarily to be limited to the essential. The following figures serve as an indication of the number of hours that the Division's regional officers (officers from Head Office excluded) had to spend on providing extension or information of one kind or another.

	Hours
Visits by farmers and other organisations	317
Visits to farmers (mail-in record collaborators excluded)	87
Short courses given	20
Lectures given at farmer's days	49
Replies to enquiries	1 293

In addition, numerous articles were written and radio talks given.

8. Inspection and grading services

GENERAL

The need for a well-developed Product Analysis Section again became a prominent issue when it became increasingly clear that various foreign organisations intended to insist in future on the certification of certain minimum tolerances for contaminants, pesticide residues and additives. Some organisations are already insisting on this. Checking and certification therefore became urgently necessary in order to improve the export potential of processed and unprocessed agricultural products. At present analyses of this nature are carried out on a limited scale by the Division of Inspection Services.

There is still an urgent need for liaison, training, specialisation in certain fields and at certain levels and diversification in others, better organisation, planning and general management, and this is making higher demands on the Division.

FIELD CROP PRODUCTS

Grain and grain products

During the past season 25 % more grain and grain products intended for export were inspected than in 1979. With the exception of groundnuts and tobacco, virtually all field crop products intended for export are subject to inspection by the Division. No appeals were lodged against any decisions made by officers. A total of 213 ships' holds were inspected for insect infestation; 85 had to be treated before grain could be loaded.

Table 1 gives details of the grain and grain products that were inspected for export in 1979 and 1980 and also shows rejections during 1980. The presence of foreign matter, insect infestation, too high a moisture content, maize of another colour and broken maize kernels were the main reasons for the rejections.

Rooibos tea

Only rooibos tea intended for export is subject to inspection. During 1980, 26,1 tons were inspected in Table Bay harbour, compared with 20,1 tons in 1979 - an increase of 30 %.

Cotton

The Cotton Section graded, selected and classified 254 604 bales (200 kg) of cotton, as against 181 574 bales in 1979.

HORTICULTURAL PRODUCTS

Deciduous fruit

Table 2 shows particulars of the quantities of deciduous fruit inspected during 1979 and 1980, and

TABLE 1 - Inspection of maize and maize products, for export, 1979 and 1980

	Inspected		Rejected
	1980	1979	1980
Yellow maize	2 892 274	1 846 358	4 704
Wheat	66 638	83 009	319
Sunflower seed	1 631	4 525	28
Oats	-	-	-
Barley	25 752	47 596	-
Maize products	595 292	634 338	1 646
Grain sorghum	182 597	259 975	2 352
Rice bran	-	160	-
Lucerne meal and pellets	814	564	-
Buckwheat	42 560	5 109	-
Dry beans	8 504	44 701	-
Cow-peas	-	70	-
Grass seeds	777	185	-
Chicken maize	119	54	-
Pasta maize	3 432	7 280	-
Castor-oil seed	-	-	-
Soya beans	-	499	-
White maize	134 493	247 034	-
Fodder products	6 039	5 801	-
Other	16	15	-
Total	3 920 938	3 147 273	9 049

quantities rejected in 1980. According to this table there was an increase of 20 % in the number of units that were inspected on the local markets. Of the deciduous fruit inspected for local marketing, 15 % was downgraded. The main reasons for downgrading were unripe fruit, hail damage, spoilage, bruises, insect damage and sunburn.

The embargo on certain classes of apples and pears emphasised the importance of quality control. A lively interest was shown in the quality standards of these products and co-ordination was frequently necessary.

The total supply of deciduous fruit intended for export increased by 2 %. Of this, 4 % was rejected at the harbours. The main reasons for the rejections were bruises, sunburn, insect damage, hail damage, cracking, injuries, spoilage, bitter pit, faulty packing and undersized fruit.

Citrus

Table 3 gives details of the quantities of citrus fruit that were inspected during 1979 and 1980 and that were downgraded or rejected during 1980.

The number of containers inspected during 1980 in the controlled areas increased by 0,2 % compared with 1979. Of this total 9 % was downgraded. The main reasons for the downgrading were oleocellosis, blemishes, spoilage, scale and thrips.

Inspectors of the Division again carried out inspections of export citrus at a number of the biggest up-country warehouses.

TABLE 2 - Inspection of deciduous fruit, 1979 and 1980

	Inspected		Downgraded/ rejected
	1980	1979	1980
	1 000 containers		
<i>Local market</i>			
Apples	5 002	4 479	543
Grapes	2 150	1 669	398
Pears	864	768	105
Peaches and nectarines	5 332	4 249	935
Plums and prunes	528	424	78
Total	13 876	11 589	2 059
<i>Export market</i>			
Apricots	63	44	22
Apples	10 320	9 994	455
Grapes	7 561	7 818	175
Pears	2 880	2 903	109
Peaches and nectarines	339	342	30
Plums and prunes	1 227	905	36
Total	22 390	22 006	827

In 1980 3% more export citrus was offered for inspection than in 1979. 5% of the fruit which was inspected at the export harbours was rejected. The main reasons were oleocellosis, blemishes, skin cracking, spoilage, poor grading for size, underweight and loose flaps of cartons.

TABLE 3 - Inspection of citrus fruit, 1979 and 1980

	Inspected		Downgraded/ rejected
	1980	1979	1980
	1 000 containers		
<i>Local market</i>			
Oranges	5 741	5 783	583
Naartjies	1 213	1 063	59
Grapefruit	704	841	59
Lemons	477	430	45
Total	8 135	8 117	746
<i>Export market</i>			
Oranges	22 593	22 892	1 105
Grapefruit	6 629	4 700	143
Lemons	1 764	1 524	88
Other	227	223	44
Total	30 213	29 339	1 380

Other fruit

1,001 million containers of avocados were inspected on the local markets during 1980; of this number 255 370 containers were downgraded (26%). There was a 9% decrease in the supply compared with the figures for 1979.

Table 4 shows the quantities of other types of fruit which were inspected for export during 1979 and 1980. The reasons for rejection were injuries, blackheart, bruises, blemishes, black spot, overripe fruit, refrigeration burn and cold damage.

TABLE 4 - Inspection of other types of fruit for export, 1979 and 1980

	Inspected		Downgraded/ rejected 1980
	1980	1979 Containers	
Avocados	3 495 704	2 516 618	35 740
Cherries	13 667	27 654	365
Litchis	174 924	124 970	27 708
Mangoes	191 431	237 296	37 832
Pawpaws	3 059	12 905	-
Pineapples	519 239	394 777	16 923
Muskmelons	333 281	260 183	17 854
Strawberries	48 908	84 482	1 463
Other	4 921	10 425	-
Total	4 785 134	3 669 310	137 885

Vegetables

Table 5 shows the quantities of vegetables inspected during 1979 and 1980 and also indicates downgradings or rejections.

69% of the onions, 15% of the tomatoes and 52% of the potatoes were downgraded on the local markets. In the case of onions the main reasons for the downgrading were double bulbs, seed stalks, spoilage, shoots, bruises and greening.

In the case of tomatoes the reasons for the downgradings were softness, sunburn, blemishes, spoilage and mosaic infection. Downgrading in the case of potatoes can be ascribed mainly to insect damage, mechanical damage, potato tuber moth, brown scab, greening and soil residues.

TABLE 5 - Inspection of vegetables, 1979 and 1980

	Inspected		Downgraded/ rejected
	1980	1979	1980
<i>Local market</i>			
Potatoes	31 220 652	28 530 627	16 085 049
Dry onions	8 543 487	8 781 875	5 926 823
Tomatoes	24 817 729	22 772 696	3 675 613
Total	64 581 868	60 085 198	25 687 485
<i>Export market</i>			
Potatoes	1 446 941	903 951	20 782
Dry onions	1 114 916	785 266	60 605
Tomatoes	53 179	55 270	618
Asparagus	77 724	136 508	425
Aubergines (egg fruit)	7 399	8 070	553
Capsicums (sweet peppers)	86 067	94 177	6 789
Garlic	26 842	22 374	2 372
Corn on the cob	68 490	89 196	195
Lettuce	16 073	12 974	834
Cauliflower	6 354	6 746	20
Green beans	25 533	60 251	4 016
Courgettes	1 469	1 733	-
Green onions	-	6 239	-
Carrots	14 095	16 995	65
Cucumbers	2 718	2 963	12
Cabbage	19 224	19 909	-
Chillies	43 978	27 223	2 523
Celery	1 986	2 478	5
Other	11 188	11 973	16
Total	3 024 176	2 264 296	99 830

34 % more vegetables intended for export were inspected compared with 1979.

Apricot and peach stones

During 1980, 327 tons of apricot and peach stones intended for export were inspected at canning factories in the Western Cape, compared with the 334,1 tons during 1979. This shows a decrease of 2 %.

Flowers

During the year under review 397 919 containers of flowers intended for export were inspected, compared with 461 697 units during 1979 - a decrease of 12 %.

TABLE 6 - Inspection of flowers for export, 1979 and 1980

Inspected	Containers	
	1980	1979
Cut flowers	77 659	97 582
Bulbs	2 813	1 968
Dry flowers	57 113	57 652
Proteas	150 184	287 642
Chinkinerchees	9 044	15 892
Orchids	625	961
Other	481	-
Total	397 919	461 697

PROCESSED HORTICULTURAL PRODUCTS

Canned products

On the whole the quality of canned products was very high and no serious deviations were revealed by inspections. Regular inspections are carried out at a number of canning factories, but products intended for processing are inspected less intensively.

Table 7 gives particulars of canned fruit and vegetables inspected in 1979 and 1980. During the year under review inspections of canned fruit and vegetables increased by 38 %, but the quantities offered and inspected for export decreased by 4 %.

TABLE 7 - Inspection of canned fruit and vegetables, 1979 and 1980

	Total inspected	Offered and inspected for export
	t	
1979	293 400	255 439
1980	403 317	245 079

Tables 8 and 9 show analyses of the inspection of canned products during 1980, according to type of product.

TABLE 8 - Analysis of inspections according to type of canned product, 1980

<i>Canned fruit</i>	
Dessert	257 155
Jam	38 916
Juice	16 513
Other	7 360
Total	319 944
<i>Canned vegetables</i>	
Table dish	60 784
Juice	730
Salad	2 858
Other	6 189
Total	70 561
<i>Other</i>	
Soup	947
Mushrooms	3 516
Pasta	5 183
Baby food	3 166
Total	12 812

TABLE 9 - Analysis of inspections for export, 1980

	t
Jam	3 698
Fruit	223 885
Purées	6 954
Juices	8 935
Vegetables and other	1 607
Total	245 079

Frozen fruit and vegetables

During 1980, 41 624 tons of frozen fruit and vegetables were inspected at freezing plants, as against 35 426 tons during 1979 - an increase of 18 %. Of this quantity, 5 638 tons were offered for inspection, for export.

Dried fruit

Sultanas were the main type of dried fruit inspected and represented 68 % of the total by mass. Table 10 shows the quantities of dried fruit submitted for inspection at the Wellington, Worcester and Upington warehouses. During the year under review 4 % more dried fruit was inspected than during 1979.

TABLE 10 - Inspection of dried fruit, 1979 and 1980

	Inspected		Rejected
	1980	1979	1980
	t		
Raisins	853,0	1 379,1	1,6
Sultanas	20 808,3	14 324,7	1,2
Apricots	1 457,3	1 446,2	1,8
Mixed fruit	3 777,1	3 922,5	-
Peaches	1 357,0	1 431,9	2,1
Pears	284,3	319,4	2,5
Prunes	141,1	1 222,7	1,3
Other	2 131,1	5 555,8	5,0
Total	30 809,2	29 602,3	15,5

ANIMAL PRODUCTS

Dressed poultry and eggs

Tables 11 and 12 contain particulars of the inspection of dressed poultry and eggs during the past two years.

TABLE 11 - Inspection of dressed poultry, 1979 and 1980

	1980	1979
<i>Locally marketed</i>		
Chickens (1 000 carcasses)	137 857	114 105
Turkeys	320 317	275 980
<i>Export inspections</i>		
Chickens (1 000 carcasses)	16 059	19 617
Portions (cartons)	58 908	49 214
Ducks (carcasses)	51 322	51 816
Ducks' feet (cartons)	666	1 212
Moisture determinations done	6 681	6 975

TABLE 12 - Inspection of eggs, 1979 and 1980

	1980	1979
<i>Export (cases of 30 doz)</i>		
Offered	122 051	1 258 899
Inspected	9 209	76 278
<i>Local (doz)</i>		
Warehouses	418 146	71 923
Retail trade	497 888	261 868
Haugh unit determinations	1 158	358

Dairy products

Tables 13 to 16 contain a summary of the butter inspected during the past two years.

TABLE 13 - Inspection of choice grade butter, 1979 and 1980

	Number of churnings		Mass	
	1980	1979	1980	1979
Locally marketed	18 375	17 731	18 314	18 487
Export	1 066	700	885	677
Re-offered	62	4	62	5
<i>Embargo on sale owing too</i>				
To much salt	0	4	0	4
Too much moisture	100	10	89	19

TABLE 14 - Inspection of table butter, 1979 and 1980

	Number of churnings		Mass	
	1980	1979	1980	1979
Locally marketed	1 843	1 535	1 444	1 288
Exported	6	0	5	0
Re-offered	33	41	23	30
<i>Embargo on sale owing too</i>				
Too much salt	0	0	0	0
Too much moisture	4	1	2	1

During 1980 appeals were lodged against the decisions of inspectors concerning 177 churnings of butter, representing 171 tons of butter. Appeals in respect of 30 churnings representing 42 tons were

TABLE 15 - Inspection of household butter, 1979 and 1980

	Number of churnings		Mass	
	1980	1979	1980	1979
Locally marketed	57	176	37	123
Exported	0	0	0	0
Re-offered	7	19	4	13
<i>Embargo on sale owing too</i>				
Too much salt	0	0	0	0
Too much moisture	0	0	0	0

TABLE 16 - Downgrading of butter during inspections, 1979 and 1980

	Number of churnings		Mass	
	1980	1979	1980	1979
Choice to table butter	509	197	450	153
Choice to household	35	19	28	17
Table to household	34	12	19	6
Total	578	228	497	176

successful.

Tables 17 and 18 show the number of analyses made of margarine and milk products during the past two years. It appears that the number of analyses of butter and cheese decreased, whereas those of products other than butter and cheese increased.

TABLE 17 - Number of laboratory analyses (moisture, salt, fat, curd and pH determinations), 1979 and 1980

	1980	1979
Margarine	5 364	5 046
Butter	10 446	17 171
Cheese	3 646	5 934
Cottage cheese	618	291
Processed cheese	219	94
Buttermilk	213	-
Yoghurt	799	-
Milk powder	291	-

TABLE 18 - Number of analyses of milk done at factories, 1979 and 1980

	1980	1979
<i>Factory milk</i>		
Composite samples (fat)	42 861	51 360
Scale-pan samples (fat)	15 823	13 085
Retesting (fat)	1 434	1 636
Methylene blue test	33 295	48 624
Sediment	1 660	-
<i>Fresh milk</i>		
Fat	2 139	2 840
Solids not fat	2 288	2 339
Freezing point	269	324
pH	1 469	1 513
Sediment	40	-

With few exceptions fresh milk complied with the composition requirements. Follow-up work was carried out successfully where necessary. During

inspections cheese was placed in various classes, as indicated in Tables 19 to 21. Corresponding figures for 1979 are given in brackets.

TABLE 19 - Inspection of Cheddar, 1980

	Choice	Standard Vats	Undergrade
<i>Local</i>			
Rindless	22 521 (22 237)	962 (538)	148 (104)
Round	173 (220)	2 (2)	5 (4)
<i>Export</i>			
Rindless	66 (49)	0 (0)	0 (0)
Total	22 760 (22 506)	964 (540)	153 (108)

	Mass t		
<i>Local</i>			
Rindless	14 746 (14 427)	505 (285)	86 (77)
Round	85 (117)	1 (1)	4 (5)
<i>Export</i>			
Rindless	24 (20)	0 (0)	0 (0)
Total	14 855 (14 564)	506 (286)	90 (82)

TABLE 20 - Inspection of Gouda, 1980

	Choice	Standard Vats	Under- grade
<i>Local</i>			
Rindless	4 206 (3 327)	173 (29)	40 (33)
Round	10 736 (13 723)	544 (480)	224 (116)
Baby	266 (35)	65 (6)	10 (1)
<i>Export</i>			
Rindless	0 (4)	0 (0)	0 (0)
Round	73 (58)	0 (0)	0 (0)
Total	15 281 (17 143)	782 (515)	274 (150)

	Mass t		
<i>Local</i>			
Rindless	2 451 (2 659)	90 (15)	24 (24)
Round	10 489 (11 617)	290 (392)	207 (106)
Baby	35 (0)	13 (1)	3 (1)
<i>Export</i>			
Rindless	0 (0)	0 (0)	0 (0)
Round	22 (19)	0 (1)	0 (0)
Total	12 997 (14 295)	393 (409)	234 (131)

An appeal was lodged against the decision of an inspector concerning six vats of Gouda. The appeal was unsuccessful.

TABLE 21 - Inspection of mature Cheddar, 1980

	Vats	Mass t
<i>Approved the first time</i>		
Rindless	0 (26)	0 (23)
Round	1 161 (1 310)	503 (560)
<i>Approved the second time</i>		
Rindless	668 (772)	644 (764)
Round	1 690 (1 310)	835 (657)
<i>Rejected</i>		
Rindless	0 (2)	0 (2)
Round	57 (33)	31 (20)

The Division's inspectors keep a check on all activities of dairy factories that affect the supplier and consumer directly. Table 22 reflects aspects of this service.

TABLE 22 - Factory checks, 1979 and 1980

	1980	1979
Can inspections	40 882	14 404
Milk receipts	37 633	26 148
Cream receipts	18 028	13 474
<i>Mass determinations carried out</i>		
Butter	10 282	10 365
Margarine	1 168	370
Milk	23 100	55 259
Cans	3 828	166
Cream	5 861	55 219
Cheese	1 867	705
Buttermilk	105	0
Other	1 472	-

Table 23 shows the number of visits paid by dairy inspectors to various persons and enterprises during the past two years.

TABLE 23 - Number of visits paid by dairy inspectors to various persons and enterprises, 1979 and 1980

	1980	1979
Margarine factories	79	90
Cheese factories	516	570
Creameries	492	579
Dairies	1 602	2 246
Condensed milk and milk powder factories	363	407
Milk depots	138	95
Agents	1 367	1 550
Packing houses (cheese)	184	147
Processed cheese factories	69	54
Farm cheese-makers	25	28
Cafés	785	522
Egg packers	332	417
Poultry abattoirs	90	182

In 1980, 79 certificates of competence in various sections of the dairy industry were issued,

compared with 91 in 1979.

GENERAL

Meat

Table 24 shows the number of carcasses graded at abattoirs in the controlled areas during the past two years.

TABLE 24 - Grading of carcasses, 1979 and 1980

	1980	1979
	1 000 carcasses	
Beef	1 636	1 651
Veal	107	118
Pork	548	580
Mutton, lamb and goat's meat	4 911	5 132
Total	7 202	7 481

Table 25 shows the quantities of meat intended for export that were inspected during the past two years.

TABLE 25 - Meat: export inspections, 1979 and 1980

	1980	1979
<i>Beef</i>		
Halves	-	903
Cuts and container	220 734	325 384
Quarters	147 948	76 324
<i>Pork</i>		
Carcases	1 046	1 261
Cuts	4 574	11 597
Containers	33 932	78 300
<i>Veal</i>		
Containers	92	0
<i>Lamb</i>		
Containers	1 594	0
Carcases	15 435	219
<i>Goat's meat</i>		
Carcases	138	0
<i>Mutton</i>		
Carcases	784	19 243
Cuts	138	-

The margarine produced by one of the seven margarine factories does not comply with the requirements in respect of poly-unsaturated fatty acids. Margarine from only two of the factories complied with the specifications throughout the year under review. Furthermore, advertisements are not always in accordance with the regulations and numerous discussions were held with manufacturers to improve the situation.

A milk powder factory made a major breakthrough during the past year when it began producing an instant full-cream milk powder. In the past serious problems were experienced with reconstitution, but as a result of a technological breakthrough the full-cream milk powder now has the same reconstitution characteristics as instant skim-milk powder.

A factory which started as a goat's milk farm cheese-maker was registered as a cheese factory and is now mixing cow's milk and goat's milk for cheese-making purposes. Its product has already received high praise.

OTHER ACTIVITIES

Regular inspections were carried out at the stores of organisations which purchase their products through State Purchases. 11 594 retailers and wholesalers were inspected and altogether 9 620 premises (plant products) and 1 974 premises (animal products) were visited.

9. Co-operative matters

NUMBER OF REGISTERED CO-OPERATIVES

During 1980 agricultural and special farmers' co-operatives were reduced by two and trading co-operatives increased by one. The numbers and changes are shown in Table 1.

TABLE 1 - Number of registered co-operatives at 31 December 1980

	Type of co-operative		Total
	Agricultural and farmers' special co-operatives	Trading co-operatives	
Number at 31 December 1979	319	216	535
New registrations	6	13	19
Cancellations	8	12	20
Number at 31 December 1980	317	217	534

NEW REGISTRATIONS

Agricultural co-operatives

The six new registrations represent two amalgamations, one feed-lot, one loose citrus, one banana and one egg co-operative.

Trading co-operatives

The 13 newly registered trading co-operatives consist of two amalgamations, seven home industries co-operatives, three consumer co-operatives and one handicraft co-operative.

LIQUIDATIONS AND CANCELLATIONS

Agricultural co-operatives

On 31 December 1980, 11 agricultural and farmers' special co-operatives were in liquidation. Three of these were placed in liquidation during 1980. Eight agricultural co-operatives were removed from the register, two of them owing to inactivity, five because of amalgamation and one owing to the fact that it had been in liquidation since the previous year.

Trading co-operatives

On 31 December 1980 eight trading co-operatives were in liquidation. Three consumer co-operatives were placed in liquidation during 1980. Four home industries and three consumer co-operatives were struck from the register. Of

these, two home industries co-operatives and the three consumer co-operatives had been in liquidation since the previous year. The other five cancellations were in respect of the two amalgamations that had taken place.

TURNOVER OF AGRICULTURAL AND FARMERS' SPECIAL CO-OPERATIVES

Table 2 gives particulars of the turnover of agricultural and farmers' special co-operatives in 1980, with comparable figures for the previous year.

Table 3 shows the turnover according to product.

TABLE 2 - Turnover of agricultural and farmers' special co-operatives, 1979 and 1980

	1980	1979
	R million	
Agricultural produce	4 581,3	3 860,8
Farming requisites	1 626,6	1 243,0
Services	220,1	192,2
Total	6 428,0	5 296,0

During 1980 the total turnover of these co-operatives increased by 21,4 %. Twenty-four co-operatives or 7,6 % were responsible for 69,4 % of the total turnover of agricultural co-operatives.

The total turnover of produce rose by 18,7 % during 1980 and that of farming requisites by 30,9 %. As a result of price slumps there was a drop in the turnover of mohair and hides and skins in 1980.

TURNOVER OF TRADING CO-OPERATIVES

Details of the total turnover of trading co-operatives are given in Table 4.

The total turnover of trading co-operatives rose by 14,8 %.

Under the heading "Miscellaneous" are included four employees' associations, one co-operative that undertakes abattoir services, one salt marketing co-operative, one brick and tile marketing co-operative and one co-operative fishery.

TABLE 3 - Product turnover of agricultural and farmers' special co-operatives, 1979 and 1980

	1980	1979
	R million	
<i>Grain and oilseeds</i>	1 916,8	1 630,0
Maize	742,4	665,3
Wheat	331,0	253,1
Other winter cereals	20,1	16,9
Grain sorghum	31,1	31,1
Peanuts	56,8	58,3
Sunflower seed	60,0	72,4
Seed (all kinds)	44,1	31,4
Beans and peas	15,0	13,8
Manufactured grain products	472,8	356,9
Miscellaneous	6,5	1,4
Handling and storage	137,0	129,4
<i>Livestock and meat</i>	1 012,0	775,1
Livestock	838,0	635,6
Meat and processed meat products	87,1	68,5
Poultry and eggs	73,8	59,2
Ostrich products	13,1	11,8
<i>Dairy products</i>	306,3	210,2
Butter	45,7	33,2
Cheese	83,9	62,2
Milk	109,7	71,5
Milk and whey powder	27,0	19,4
Miscellaneous dairy products	40,0	23,9
<i>Wool, mohair, pelts, hides and skins</i>	348,7	350,7
Wool	191,4	182,1
Karakul pelts	65,3	51,3
Mohair	39,6	56,1
Hides and skins	52,4	61,2
<i>Fruit and vegetables</i>	551,5	507,2
Citrus	276,0	259,7
Deciduous fruit	55,7	49,4
Dried fruit	38,2	32,4
Subtropical fruit	6,2	5,4
Potatoes	15,0	12,0
Canned and processed products	151,1	126,2
Fresh vegetables and other fruit	9,3	22,1
<i>Other</i>	446,0	387,6
Wine	183,5	172,0
Tobacco	118,2	96,8
Sugar	40,6	40,8
Cotton	49,0	25,9
Lucerne hay	5,6	3,6
Wood and wattle bark	41,4	35,1
Miscellaneous products	7,7	13,4
Total	4 581,3	3 860,8

TABLE 4 - Turnover of trading co-operatives, 1979 and 1980

	1980	1979
	R million	
Consumer co-operatives	105,5	92,8
Home industries	4,8	3,7
Mutual aid societies	73,1	64,3
Garages	18,0	14,6
Miscellaneous	9,3	8,2
Total	210,7	183,6

FINANCIAL POSITION OF AGRICULTURAL AND FARMERS' SPECIAL CO-OPERATIVES AND TRADING CO-OPERATIVES

Agricultural co-operatives

Table 5 gives details of the financial position of agricultural and farmers' special co-operatives as at 31 December 1979 and 1980.

TABLE 5 - Consolidated balance sheet of agricultural and farmers' special co-operatives as at 31 December 1979 and 1980

	31.12.80	31.12.79	% increase/decrease
	R1 000		
<i>Assets</i>			
Fixed	890 948	807 181	+ 10
Liquid	2 585 812	2 163 042	+ 20
Other	3 872	2 156	+ 80
Total	3 480 632	2 972 379	+ 17
<i>Financing of assets</i>			
Own means	1 097 011	996 522	+ 14
Long-term loans	259 260	244 957	+ 6
Short-term loans	1 468 208	1 275 286	+ 15
Creditors	656 153	485 614	+ 35
Total	3 480 632	2 972 379	+ 17
<i>Analysis of own means</i>			
Paid-up share capital	64 373	63 998	+ 1
Reserves*	653 011	603 373	+ 8
Members' funds	311 661	251 409	+ 24
Undivided surpluses	67 966	47 742	+ 42
Total	1 097 011	966 522	+ 14

*Reserves were reduced by the accumulated losses, amounting to R6 533 062 in 1979 and R6 075 231 in 1980.

Fixed assets show an increase of 10 % compared with the investment of the previous year. Long-term loans increased by 6 % compared with the previous year. Total external means increased by 19 %, and own means increased by 14 %.

The financing ratio showed a very slight deterioration compared with the previous year. 32 % of the investment in total assets was financed from own means and 68 % from external sources. The corresponding figures for 1979 were 33 % and 67 % respectively. The investment of own means in operating assets amounted to 17,8 % as against 18,6 % in 1979. This shows that short-term external sources and creditors are being used to an increasing extent to finance operating assets.

Operating assets increased by 19,5 %. 82,8 % were financed by external means, compared with 81,4 % in 1979. The most important increases in operating assets were the increases in members' debtors (32,5 %) and commercial stock (15,1 %).

Table 6 shows the contributions of the respective sources to the composition of own funds (undistributed surpluses excluded).

Total own funds increased by R111 million (12 %). Members' funds and reserves contributed R61 million and R50 million respectively to this

TABLE 6 - Share capital, members' funds and reserves of agricultural and farmers' special co-operatives, 1979 and 1980

	Share capital	Members' funds R million	Reserves	Total
1979	64	251	603	918
1980	64	312	653	1 029

increase. This represents increases of 24 % and 8 % respectively. Share capital showed a small increase of about 0,5 % as against a decrease of 6 % in 1979.

From the above it can therefore again be deduced that reserves and members' funds are of vital importance to co-operatives as a source of financing. Share capital remained stable during 1980 but it is still decreasing in importance.

In order to meet the ever increasing demands of producers in respect of handling facilities and supply and technical services, co-operatives are obliged to reserve a larger share of their annual surpluses and to obtain bigger contributions from members in the form of members' funds.

Trading co-operatives

Table 7 shows details of the financial position of trading co-operatives as at 31 December 1979 and 1980.

TABLE 7 - Consolidated balance-sheet of trading co-operatives as at 31 December 1979 and 1980

	31.12.80	31.12.79	% increase/ decrease
	R1 000		
<i>Assets</i>			
Fixed	16 389	15 599	+ 5
Liquid	51 240	46 435	+ 10
Other	58	65	- 11
Total	67 687	62 099	+ 9
<i>Financing of assets</i>			
Own funds	33 507	31 260	+ 7
Long-term loans	4 681	3 016	+ 55
Short-term loans	7 909	7 869	+ 1
Creditors	21 590	19 954	+ 8
Total	67 687	62 099	+ 9
<i>Analysis of own funds</i>			
Paid-up share capital	5 705	5 700	-
Reserves*	12 838	12 800	-
Members' funds	10 314	8 649	+ 19
Undistributed surplus	4 650	4 111	+ 13
Total	33 507	31 260	+ 7

*Reserves were reduced by the accumulated losses, which amounted to R1 697 242 in 1980 and to R742 699 in 1979

Fixed assets increased by R0,790 million (5,1%) and own funds by R2,247 million (7,2%) compared with the previous year. Current assets showed an increase of R4,805 million (10,3 %).

The above therefore shows that the increase in own funds was more than adequate to finance the increase in fixed assets, although it was insufficient to finance the increase of R4,805 million in current assets.

Long-term loans showed an increase of R1,665 million (55,2 %), which in turn made an additional R0,874 million (6,9 %) in own funds available for financing current assets.

The increase of R4,805 million (10,3 %) in current assets occurred mainly in the case of debtors and trade supply, where increases of R2,488 million (13,7 %) and R1,638 million (8 %) respectively occurred.

Table 8 shows the contributions of the various sources to the composition of own funds (undistributed surpluses excluded).

TABLE 8 - Share capital, members' funds and reserves of trading co-operatives, 1979 and 1980

	Share capital	Members' funds R million	Reserves	Total
1979	5,7	8,7	12,8	27,1
1980	5,7	10,3	12,8	28,8

Members' funds represent the most important increase (19 %).

ACTIVITIES

During 1980, 15 general and two special investigations were undertaken. The financial statements of a number of trading, agricultural and farmers' special co-operatives were fully analysed and certain problems were pointed out to them.

The registration of 19 co-operatives was completed. A total of 190 amendments of articles of association, including five consolidations of articles of association, were registered and 136 Ministerial approvals were granted.

DEVELOPMENTS IN CO-OPERATIVE AFFAIRS

During the year considerable time was spent on interviews and deliberations in connection with the drafting of the new Co-operative Societies Act.

Over the years it had become clear that the present Act, which was placed on the Statute Book in 1939 and was subsequently amended on only a few occasions, fell far short of present-day requirements and changed circumstances, resulting largely from the phenomenal progress made by and changes in the farming industry. The object of the new Act is to bring the existing Act up to date and in some cases to eliminate antiquated and obsolete provisions, while streamlining administrative procedures and, where necessary, bringing them into line with present-day practices and procedures.

An important development in co-operative affairs that occurred in the course of the year was the increase in co-operation between agricultural and trading co-operatives. The object of this co-operation, which manifested itself in various ways, is to bring about benefits for both agricultural and trading co-operatives. Much closer liaison on the administrative level has been

established in the process, overlapping of functions is eliminated and more stress is placed on the importance of trading co-operatives as a channel for the marketing of the manufactured products of agricultural co-operatives. The South African Agricultural Union and the Verbruikers Groothandel Koöperatief Beperk established a committee whose task it is to bring about a closer liaison between agricultural and trading co-operatives, and which can deal with matters of common interest. A representative of the Co-operatives Division serves on this Committee. It was also agreed that the trading co-operatives could nominate an observer to the Co-operative Council of the South African Agricultural Union and in future trading co-operatives will be allowed to attend the co-operative congresses of the South African Agricultural Union.

TABLE 9 - Summary of the financial position of all registered co-operatives as at 31 December 1980

	Agricultural and farmers' special co- operatives	Trading co-opera- tives	Total
	R1 000		
<i>Assets</i>			
Fixed	890 948	16 389	907 337
Floating	2 585 812	51 240	2 637 052
Fictitious	3 872	58	3 930
Accumulated deficits	6 075	1 697	7 772
Total	3 486 707	69 384	3 556 091
<i>Financing of assets</i>			
Paid-up capital	64 373	5 705	70 078
Members' funds	311 661	10 314	321 975
Reserves	659 086	14 536	673 622
Undistributed surplus	67 966	4 649	72 615
Long-term loans	259 260	4 681	263 941
Crop loans	1 335 883	-	1 335 883
Short-term loans	132 325	7 909	140 234
Creditors	656 153	21 590	677 743
Total	3 486 707	69 384	3 556 091
Subscribed share capital	128 194	6 329	134 523

Regional overlapping between co-operatives and duplication of functions remain one of the most important problems in the industry. During the year under review considerable attention had to be given to complaints and internal differences in this connection.

STATISTICS

Tables 9 to 11 give more details concerning the number, membership, turnover and financing of co-operatives.

TABLE 10 - Number and membership of all registered co-operatives as at 31 December 1980

	Number	Membership
<i>Agricultural and farmers' special co-operatives</i>		
Marketing	171	209 082
Manufacturing	89	49 498
Supply	17	14 090
Services	40	20 915
Total	317	293 585
<i>Trading co-operatives</i>		
Shops	97	68 036
Home industries	91	2 911
Garages	11	1 513
Mutual-aid	8	17 333
Buying societies	2	39 636
Fisheries	1	196
Miscellaneous	7	4 122
Total	217	133 747

TABLE 11 - Turnover of all registered co-operatives, 1979 and 1980

	Agricultural and farmers' special co-operatives				Trading co-opera- tives	Total
	Agricultural products	Farming requirements	Services	Total		
	R1 000					
1979	3 860 829	1 242 977	192 191	5 295 997	183 645	5 479 642
1980	4 581 271	1 626 587	220 124	6 427 982	210 708	6 638 690

10. Plant production improvement

FIELD HUSBANDRY RESEARCH SUMMER CEREALS

MAIZE BREEDING

The Maize Breeding Section at Potchefstroom (Summer Grain Centre) launched successful breeding programmes at Potchefstroom, Vaalharts, Burgershall and Oudtshoorn.

At the same time an extensive nation-wide sweetcorn programme was launched in co-operation with the private canning industry to support the Departmental breeding programme concerned with developing an indigenous sweetcorn hybrid.

Good relations with friendly neighbouring states in Southern Africa were maintained and improved by the planting of the SARMEIT maize cultivar yield trials, which were co-ordinated from Potchefstroom.

The highlights of the breeding programmes of the past season were the following:

- The composition of six different breeding populations from breeding material from the USA and South Africa.
- Disease selection for red rust *Puccinia sorghi*, head rots *Diplodia maydis* and streak, which made good progress owing to the natural occurrence of the diseases.
- The successful completion of the development of a group of pure lines that are resistant to streak. These lines will be released to the private sector during the coming season.

The Maize Breeding Centre of the Summer Grain Subcentre at Pietermaritzburg released the following breeding material during the year under review:

5 locally developed breeding populations

12 breeding populations developed in the USA

8 medium-late yellow breeding lines

7 medium to early yellow breeding lines

4 medium to medium-late white breeding lines.

In addition to a good capacity for combining, the breeding lines in general show extremely high resistance to lodging and resistance to diseases, especially leaf blight *Helminthosporium turcicum*.

Three of the locally developed breeding populations contain a varying percentage of tropical germ plasm and are extremely sensitive to day length.

The released breeding populations, which are known as the F2834T composite and the M37 composite, probably represent the most promising local breeding sources and should shortly provide valuable new breeding material for the country's maize breeders.

Good progress has been reported with the breeding of a yellow high lysine hybrid, which will be of especial importance to the stock feed industry. The white high-lysine hybrid, HL1, is already commercially available.

Cultivar evaluation

Cultivar recommendations for this crop are now being made on the basis of perennial regression lines. The evaluation of cultivars for acid tolerance is being continued and cultivar differences are becoming apparent.

Grainsorghum

Material from ICRISAT was planted for evaluation at Potchefstroom during the past season. Cultivar recommendations on the basis of perennial regressions can be made for this crop as well.

Italian millet

Material obtained from ICRISAT was planted for evaluation at Potchefstroom during the past season.

Buckwheat

Planting date x cultivar trials were planted at three localities during the past season.

Plant nutrition

At the request of private consultants an official visit was paid to the Ncora irrigation scheme (Republic of Transkei) in connection with fertilising programmes for maize.

Together with officers of the South African Department of Foreign Affairs and Information, officers visited Confimvaba (Republic of Transkei) in connection with agricultural assistance to Transkei and a drought aid programme.

Soil samples were analysed by the laboratory of the Summer Grain Centre to assist with the drawing up of a fertilising programme.

Studies of lime-induced crop reductions were carried out in co-operation with researchers in the American State of Georgia and 400 plant samples were sent to Georgia for special analysis.

Plant diseases

Surveys

A survey of the incidence and distribution of maize root and stalk pathogens in the maize producing areas of the Republic was concluded in co-operation with the Department of Botany of the Potchefstroomse Universiteit vir CHO. Results are being compiled, with descriptions and keys, with a

view to releasing information that will facilitate the identification of pathogens.

Leaf diseases

Successful results were obtained in trials in which new maize cultivars were evaluated for resistance to Northern leaf blight *Exerohilum turcicum*.

Southern leaf blight *Helminthosporium maydis* race T. cultivar evaluation trials were carried out to determine the incidence of *T - cms* genotypes and consequent resistance to the disease. Results are available.

Smuts

Cultivar resistance evaluation trials were carried out for head smut *Sphacelotheca reiliana* and boil smut *Ustilago maydis*. Results are available.

Grain sorghum diseases

A survey on the incidence of ergot *Spacelia sorghi* was carried out in the Highveld Region and a correlation established between the incidence of the disease and rainfall, flowering date and cultivar.

WINTER CEREALS

The past year was characterised by very poor climatic conditions for small grain culture. For instance, the Free State, which is responsible for over 60% of the country's wheat crop, received about 50% of the normal rainfall for wheat production. The low rainfall restricted certain irrigation programmes and alternative arrangements had to be made. For this reason increasingly strong emphasis was placed on the concept of adaptation and where possible trials were more strategically located.

Cultivar and elite trials

Elite trials made it possible to evaluate new material thoroughly before considering it for release. At the same time cultivar trials provided new information on adaptation and agro-practices in relation to specific cultivars in particular areas. This information led to a more specific national cultivar list, which is a great advantage to agricultural advisers and producers.

- These trials made it possible to release the oats line IORN 76/37 for the Free State under the name of *Witteberg*. The cultivar yields well, has a good grazing potential and will replace the well-known cultivar *Letoria*.
- The provisionally released barley cultivar, *Loerie*, was finally released for the Western Cape. This barley cultivar will replace the well-known *Swanneck*.
- After successful testing the durum line D 6962 was released for the Fish River production area under the name of *Fargo*. This cultivar will supplement the only existing cultivar, *Nordum*.

- The trials launched with barley in the Eastern Free State showed that this area could possibly be developed as a barley producing area in future. This is very valuable information, since the consumption of barley exceeds production and new barley production areas will therefore have to be exploited.

Supply of foundation seed

This programme gained further momentum, was better co-ordinated and was able to supply high quality seed to the industry. During the past year 511 tons of foundation wheat seed, 169 tons of foundation oats seed, 26 tons of barley seed and 5 tons of foundation rye seed were supplied to the industry. This scheme makes an exceptional contribution to the quality of small grain seed at the producer level.

Weed control

Wild oats is regarded as the most important weed in small grain. As a result of the limited number of researchers in this field and the seriousness of the problem several research aspects were identified by the Weed Control Task Group and divided among researchers of the Department and the Universities, for maximum efficiency. Work on some of these research topics will begin during the coming season.

On the basis of available data the safe stages for spraying with phenoxy weedkillers were extended during the past year from growing point development stages 7 to 13, for wheat. This change holds major advantages for producers, in that the cheaper weedkiller can be more effectively applied.

Alternative crops

The programme confirmed that cold weather legumes are far more resistant to cold than hot weather legumes. As a result of the very poor season the early planting of the cold weather crops could not develop to the optimum, however. On the other hand the hot weather crops responded very favourably and in the case of soya beans over 14 tons of dry material per ha was harvested during the stiff dough stage. It was also established that the various cold weather crops fixed varying quantities of nitrogen in the soil.

Crop physiology

Researchers concentrated mainly on identifying cultivars that are more tolerant of drought. The technique that produced the best results involved water potential, stoma resistance and to a lesser extent leaf surface temperature.

It appeared that the cultivars *Scheepers 69* and *SST 102* still produce a fair yield at a moisture level of only 20% of field capacity. It therefore appears possible to identify wheat cultivars with a higher drought tolerance so that they can undergo further genetic investigation.

Plant nutrition

It appeared that under irrigation optimum grain yields could be obtained with a nitrogen application of 90 - 110 kg/ha. In the case of phosphate 25 kg/ha was sufficient, if the soil already had a fairly high phosphate status. In dryland conditions in the Free State the original fertilising standards were refined and it was possible to divide the Free State into four regions in respect of extension on nitrogen application.

The programmes on the distribution of nitrogen applications, leaf spraying, fertiliser placing and liming trials did not produce any significant information.

Entomology

Researchers have concentrated solely on the Russian wheat aphid *D. noxia*, which again assumed serious proportions in the Eastern Free State and spread over virtually the whole country including the Southern and Western Cape.

The evaluation of a wide range of crops and grass species showed that *D. noxia's* host plant series is restricted to wheat, barley, durum, triticale and *Bromus willdenowii*.

According to field trials, *D. noxia* is more harmful on wheat in the early growing stages (up to the end of the stooling stage) and producers were recommended to apply chemical control measures to wheat at this stage if the infestation level reached 20%. It was recommended that during the later growing stages spraying should be applied at an infestation level of 30%.

Fifteen wheat cultivars and species were evaluated for resistance to *D. noxia*. In the investigation for sources of resistance the emphasis fell on wheat-rye translocations in primitive wheat species.

Virological studies showed that *D. noxia* can transmit two viruses to wheat but the frequency with which this takes place under field conditions could not be determined.

Ecological studies identified volunteer wheat as the chief overwintering source and warnings to producers to destroy volunteer wheat and grow oats as early grazing were emphatically conveyed through the media.

All registered insecticides provided good control of the Russian wheat aphid.

Studies are in progress to identify the toxin of *D. noxia*.

Plant pathology

If an effective breeding programme for resistance to stem rust is to be promoted it is necessary to monitor the biotype of the prevailing stem rust spectrum continuously. Last year about 300 specimens from all parts of the Republic and even from neighbouring states were received and classified. Breeding lines and international germ plasm were also investigated, and about 8 000

specimens were specifically tested for Sr TT1 type stem rust.

International co-operation

Contacts with neighbouring states were strengthened through the SARWEIN programme and in addition to certain specific visits to all SARWEIN collaborators an exchange of germ plasm took place. During the past year, in fact, 48 germ plasm nurseries were sent to 9 African countries and nine countries outside Africa.

Quality physiological research

A further aspect of industry-oriented research is related to research on resistance to sprouting in wheat breeding lines. This year up to 30% sprouted wheat was found in the Swartland alone. Research on this subject over the past two years showed that apart from particular environmental factors such as temperature and humidity, there are specific inherent genetic physiological factors closely related to the tendency of particular cultivars to sprout. These factors include poor dormancy and the presence of certain chaff inhibitors.

This research is being undertaken in co-operation with the Plant Breeding Institute at Cambridge and the Grain Research Commission at Winnipeg, Canada.

Breeding

The development of new breeding lines in the various categories of small grain has necessarily to take the needs of the industry into account, and in addition to breeding for resistance to disease, high quality and yield, researchers have to breed new lines that meet the requirements mentioned above. The winter and intermediate wheat breeding programme is aimed chiefly at cultivars adapted to the dryland conditions of the Transvaal and Free State Highveld areas. A total of 49 new promising breeding lines were widely tested in this area and after three years of testing the new cultivar *Wilge* was made available for release to the industry. At present the programme consists of the following numbers of breeding lines at various stages of development:

570 new crossings

8 100 selections from segregating populations

250 breeding lines in yield trials

49 breeding lines in extensive trials over a wide area

The specific needs of the individual selection programmes were promoted in the Rûens, Swartland, Sandvet/Vaalharts and Groblersdal irrigation areas, the Springbok Flats and the Free State and Transvaal Highveld areas.

Owing to the different needs of these regions it is necessary for selections to be undertaken in each area. The newly released cultivar *Zaragoza* shows good adaptation, not only in the Vaalharts/Sandvet area, but also in the Rûens, where it did well last year on a commercial scale. A

long-straw spring wheat, *Gamka*, has recently been released for the Swartland, and *Palala* has made a good showing on the Springbok Flats.

Local breeding programmes are strongly supported by imports of germ plasm from overseas and it has been possible to identify very promising material in respect of stem rust resistance and quality.

The breeding programmes receive considerable support from a well-equipped grain technology section which, in addition to doing routine quality analyses, is actively involved in basic research on the reasons for fenological differences between particular wheat breeding lines. A programme of cultivar identification by means of acrylamidegel electrophoresis has already been launched and the band patterns of 30 cultivars are being compared at present.

HIGH PROTEIN SEEDS AND OILSEEDS

SOYA BEANS

According to the results of the national soya bean cultivar trials, promising genetic material is available at present which does considerably better in terms of seed yield and resistance to disease than the cultivars traditionally grown.

In an investigation into resistance to rootknot nematode four of the recent introductions showed resistance, and the generally grown cultivars were again shown to be highly susceptible.

GROUNDNUTS

Component analyses were carried out at Vaalharts and Potchefstroom and the results indicate that genetic progress through increasing the component is possible. Drs Hsi and Frank, two visitors from abroad, carried out a very thorough study of pod rot in groundnuts at the invitation of the Department. The valuable recommendations arising from this study are being implemented at present.

Black pod rot did severe damage to irrigated groundnuts at Vaalharts and along the Orange and Lower Vaal Rivers. No solution has been found as yet, but serious attention is being given to the problem.

Interest in groundnut cultivation is increasing. Eight farmers' days were held and the average attendance figure was 61.

Visits were paid upon invitation to Kavango (2) and Malawi to deliver lectures on groundnut cultivation to producers, extension staff and researchers. In all six lectures were presented on these occasions. Professor A.J. Norden, a world-famous groundnut researcher, visited the Republic at the invitation of the Department of Agriculture and Fisheries, to investigate the local ground-nut breeding programme and techniques of breeding for resistance. The recommendations

arising from the visit will be of value in the short and long term.

Trials to find sources of resistance to pod rot were carried out at Vaalharts. Sources with a relatively high degree of resistance were found for the first time. The development of resistant cultivars will be given priority in future.

SUNFLOWERS

A total of 42 sunflower cultivar trials were carried out at various localities which were well and truly representative of the sunflower production areas of the Republic. Two types of trials were carried out, namely standard national cultivar trials, which included 16 commercially available cultivars, and enlarged national cultivar trials, which included the above 16 cultivars plus a further 20 new cultivars not commercially available.

Except in the Free State and the far Western Transvaal climatic conditions were favourable and good production practices were followed. *Sclerotinia* head rot *Sclerotinia sclerotiorum* occurred in the Districts of Ermelo, Delmas and Koster. No further serious diseases or pests were observed. The overall average seed yield was 2 350 kg/ha. Two of the existing cultivars performed at least 10 % better than the average, and another three of the new cultivars at least 10 % better than the average. The cultivar HV 772 produced the highest average yield, namely 2 650 kg/ha.

The average oil yield was 1 010 kg/ha and three cultivars did at least 15 % better than the average; the cultivar S0209 did the best, producing 1 200 kg/ha.

The average oil yield was 1 =10 kg/ha and three cultivars did 15 % better than the average; the cultivar SO 209 did best, producing 1 200 kg/ha.

The sunflower breeding programme is still producing valuable source material for the eventual development of hybrids by the private sector. One of the most serious problems is to find good material where high yield is not linked to length. The programme is arousing considerable interest among overseas visitors who visit the production areas regularly.

DRY BEANS

The results of 15 dry bean cultivar trials showed that only four cultivars can be recommended for purification from diseases and general cultivation. Cultivar recommendations were made on a regional basis.

Good progress was made with the production of disease-free certified basic seed of the recommended cultivars. The disease-free seed scheme was researched in depth by Prof. L.O. Copeland of the U S A , who visited the country at the invitation of the Department, and made valuable recommendations for the production of disease-free seed in future.

The results obtained with plant breeding this year clearly showed that it is possible to breed cultivars with a wide adaptability. A number of

new lines produced considerably higher yields than the existing Small White canning types and have still to be tested for canning qualities. The target of the breeding programme is being expanded to include types other than the Small White canning beans.

POTATOES

Cultivar development and evaluation

The breeding programme is geared largely to the development of lines with shorter growing periods and better quality characteristics.

Two lines were selected for further multiplication during the past two years, namely:

- Line 71-33-11 has a short to medium growing season (about 100 days) and was selected in the Western Province. This line yielded very well in spring and autumn plantings and the quality was fair.
- Line 72-49-7 has a long growing season and was selected in the Highveld. This line bears yields similar to those of Sackfiller and has good foliage resistance to late and early blight. The tuber shape and quality also appear to be better than those of Sackfiller.

Of the overseas cultivars tested under South African cultural conditions, there are two cultivars that have possibilities for local cultivation, namely:

- The cultivar Astrid, with a medium growing season, which produces very good yields in all cultivation areas in spring, summer and autumn plantings. It is a yellow-fleshed table potato with a good cooking quality. Small quantities of tubers have already been supplied to a few tuber producers for multiplication.
- The cultivar Baku is a chip potato with a yellow flesh and a light brown skin. It has performed well in the Northern Transvaal, Natal and the Western Province. Baku produces especially good yields in winter plantings and under irrigation. On dry land it is inclined to produce a number of small tubers.

The elite cultivar trials in which existing cultivars are being evaluated in various cultivation areas produced the following results:

- (a) Of the late cultivars Sackfiller produced the highest yields in all cultivation areas, although the quality was generally poor, except with late summer plantings. Late Harvest made an especially good showing in autumn plantings in the Western Province and also produced fairly high yields in the Northern Transvaal and on the Highveld. Kimberley Choice yielded best in Natal in late summer plantings and showed the best quality and keeping quality throughout.
- (b) The medium cultivars Astrid, BP-1 and Up-to-Date produced the best yields. Astrid generally produced higher yields than BP-1 and Up-to-Date and the tubers were mainly of medium size.

- (c) Vanderplank remains the best early cultivar. This cultivar has an outstanding quality and keeping quality and produced the best yields in the Western Province and under irrigation in spring plantings.
- (d) Pimpernel, Baku and Kimberley Choice are the cultivars that show the best processing quality. In Natal the processing quality of Kimberley Choice was considerably better than that of Pimpernel, especially in late summer plantings.

Insects

Several chemical preparations were applied at two trial localities to determine whether the black maize beetle in potatoes can be controlled by chemical means. The damage to potatoes in the controls varied from 1,2 % to 2,5 %. As a result of the low infestation no notable differences could be obtained. The chemical control of snout beetles was investigated in the Eastern Free State and promising results were obtained. Gamma BHC-Lindane, in particular, resulted in a significant reduction in damage.

Disease-free potato seed scheme

At the Sabie seed unit, which is the source of the virus-free seed for the Board's basic seed potato scheme, a total of 15 commercial cultivars are grown, of which 11 are locally bred. The cultivars are maintained in the introduction phase until the demand for seed from the industry warrants their inclusion in the production phase.

One hundred individual plants from each cultivar are separately sampled both during the growing season (leaves) and after harvest (tubers). The plant material is tested at Roodeplaat, both serologically and by means of indicator plants, for the presence of latent viruses which would not be observed in the field. The recent inclusion of serological techniques for checking on the possible presence of potato viruses has not only lent more accuracy to the tests but has resulted in a saving of 75 percent in needed glasshouse space.

Plant disease research

The effect of irradiation in combination with fungicides for the control of post-harvest diseases and its possible use for prolonging the storage life of seed potatoes is being investigated in collaboration with the Atomic Energy Board.

Separate laboratory and field trials on the chemical control of *Fusarium* dry rot are also continuing. Indications are that the compound thiabendazole is at present the most effective compound of those tested.

A new seed treatment compound has been registered for use as a dip to control black scurf and stem canker of potatoes. This and other promising products which may shortly be registered should fill the gap left by the previously used organomercurial compounds, which may no longer

be used. An added advantage of the new compound is that dipping of seed tubers can be undertaken several weeks before planting rather than between harvest and storage of the crop.

Quintozene (PCNB) for the control of black scurf and of common scab was recently registered. Results from a number of trials in various areas of the country showed that this compound was the most successful single measure (including cultural and chemical practices) for control of the two diseases. The most important requirement in applying the chemical is that it must be well incorporated into the tuber-bearing zone of the soil at planting to be effective.

The effect on potato cultivars of various degrees of leaf roll infection was determined. With a leaf roll infection of 20 % the decrease in the yield was 10 % at most, whereas a 100 % infection was responsible for decreases of 76 %, 83 % and 82 % in BP 1, Up-to-Date and Vanderplank respectively.

COTTON

Breeding

The biggest contribution to the 1980/81 crop was made by only three cultivars, namely Acala 1517/70, Acala and Albacala, which together produced 58 % of the crop. However, the position in regard to cultivars is improving and 10 new breeding lines and imported cultivars have been included in the national cotton cultivar trials. The preliminary indications are that some of the breeding material, especially the locally bred material, is very promising.

In the Uppington area breeders' seed of the breeding line (Cape Acala x Albar 637) x Del Cerro was produced and the intention is to replace Cape Acala with this new breeding line. The fibre characteristics of this cultivar are an improvement on those of OR3, but the fibre is coarser than that of Cape Acala.

A breeding line from the crossing AET x G2 1/17/907 was also multiplied and is being tested under commercial conditions as possible substitute for Acala 1517-70 in marginal areas.

Irrigation

Cotton exposed to serious moisture stress during the early flowering period, i.e. 46 - 76 days after planting, produced 24 % less seed cotton and dryland cotton produced 43 % less seed cotton than cotton irrigated regularly.

Pest control

The presence of predators of the red spider mite on cotton was investigated in the Loskop area. The species present on unsprayed cotton belonged chiefly to the orders Hemiptera and Thysanoptera. In fields where insecticides had been applied Thysanoptera occurred more generally.

CHICORY

Climatic conditions during the first part of the year under review, up to September 1980, were generally unfavourable for the establishment of chicory and only about 5700 ha was planted as against the normal annual planting of 10 000 ha.

Despite the unfavourable conditions, 13,2 million kg of the dried product was supplied. However, this is considerably less than the requirements of about 16 million kg and it is expected to be necessary to import about 500 00 kg of the dried product, depending on further deliveries.

Branched roots (nematode infestation) and roots infected with black rot remain a problem. However, it appears from the planting date trial that this problem is aggravated by late planting (i.e. after May). Cutworms and the false wireworm are still doing a great deal of damage to newly germinated seed, although both can be controlled with existing preparations. One problem is that these preparations have not yet been registered for use. The above trials also showed that plantings from March to May produced the best yields.

The local production of chicory seed is still receiving top priority. A limited number of selected roots for seed production will be given to a few prospective seed producers in the Fish River Valley during the winter of 1981 for trial plantings. It is expected that a small quantity of seed will be available to chicory producers during April 1982 for testing at the farm level. The locally produced seed made a very good showing in cultivar trials and in a few cases produced significantly higher yields than the imported seed.

A crop succession trial with chicory and the most important annual and perennial summer and winter crops was started in an attempt to control the deterioration of chicory soils and the incidence of nematodes and black rot. Preliminary results indicate that oats has possibilities for reducing the incidence of black rot.

TOBACCO

Breeding and selection

The breeding and selection programme is aimed at increased production and the maintenance of quality. Tobacco lines with multiple resistance to disease that produce high yields of good quality tobacco were selected and tested. Low-profile production for increased yield, chemical inducement of ripening, weed and sucker control was studied successfully.

Flue-cured tobacco

The cultivar OD 80 has now been released. It is resistant to tobacco mosaic virus (TMV), powdery mildew and black shank. The selection TL33/3, which was selected in 1977/78 for resistance to a possible third race of black shank, appeared very promising over three seasons and is being kept in reserve for cases where released

cultivars are attacked by the fungus. Resistance to powdery mildew and TMV has also been found in an oriental tobacco cultivar. This has made it possible to accelerate the breeding programme and has resulted in resistance to powdery mildew being transmitted to numerous flue-cured tobacco lines. A large number of resistant lines (144) were tested for yield capacity and quality.

Black root rot *Thielaviopsis basicola* occurs in tobacco soils in some areas, where it may cause major crop losses. Breeding lines with resistance to the fungus and to the black shank fungus, powdery mildew and TMV were tested in a separate trial. Although all the lines were surpassed by TL33 in yield capacity and price per kg, they nevertheless appeared very promising.

Several lines with resistance to potato virus Y (PVY) and black shank, powdery mildew and TMV equalled TL33 in yield capacity and quality. Certain lines that already have the properties of flue-cured tobacco to a high degree remained relatively free from rootknot nematode infestation in both phytotron and field trials in which the soil was heavily infested by the nematode.

Burley tobacco

A large number of selections and imported breeding lines were tested for their reaction to disease, production capacity and quality. Several selections were very promising. In the Transvaal Lowveld, which is the chief production area, the existing cultivars and selections are increasingly being attacked by potato virus Y (PVY). Determined efforts are being made to transmit resistance to PVY through crossings from TI1406.

Air-cured tobacco

Excellent sources of resistance such as CL8 and 78H5 were built up by crossing and selection, and seed of eight very promising South American cultivars was obtained. These lines and cultivars were used together with Piet Retief Swasie, OSB and lines with resistance to black root rot in a series of crossings in which the dominant powdery mildew gene was included with considerable success.

Oriental tobacco

Breeding lines with resistance to black shank, TMV and powdery mildew were included in cultivar tests for evaluation. Resistance to rootknot nematode *M. javanica* was transmitted and further testing is taking place. Progress has also been made with the transmission of resistance to kromnek (tomato spotted wilt virus - TSWV), a virus disease that has caused major damage in certain areas of the Western Cape.

Planting methods

Flue-cured tobacco

It has been demonstrated that considerable multiplication in the plant population, topping to a limited number of leaves per plant, and a consequent considerable increase in the leaf numbers per ha accelerates ripening, boosts the yield, makes once-over possible and results in improved quality. The amount of nitrogenous fertiliser such low-profile flue-cured tobacco requires can be fairly accurately estimated on the basis of average leaf analyses. The level of an important leaf component such as nicotine can be manipulated by the judicious choice of cultivar, topping practice and plant espacement and by varying the application levels of nitrogenous fertiliser. There are major differences in the suitability of cultivars and breeding lines for low-profile production. Within limits, there are no big differences between the positions on the stem that the limited number of leaves per plant adopt, after the lugs have been broken away and the plants topped.

Light air-cured tobacco

Production practice trials over the years have demonstrated that good leaf development, yield and quality can be obtained with low-profile cultivation. The plants were planted in double rows, 25 cm apart, with an inter-row espacement of 75 cm and with the plants 25 cm apart in the rows. They were topped to six or seven leaves per plant.

Dark air-cured tobacco

Low-profile production in which the number of rows is doubled and deep topping applied to the plants produced large, dark leaves over a period of four years and resulted in fairly high production.

Burley tobacco

Low-profile methods were also successfully applied with Burley tobacco.

Double rows, 25 cm apart, with a 75 cm inter-row espacement and eight to 12 leaves per plant produced even ripening, uniformity in leaf characteristics, virtually no leaf losses and high yields of good quality tobacco. This information was acquired over a period of four seasons.

Oriental tobacco

With dense espacement of the plants and fewer leaves per plant this very labour-intensive class of tobacco can be harvested by the whole plant method and cured without any reduction in the yield. This is achieved by using double rows, 25 cm apart and with an inter-row espacement of 50 or 75 cm and 10 cm between the plants in the row; the plants are topped to 14 leaves.

Cultural methods

Induced ripening

Trials over the years have shown that with conventional flue-cured tobacco application of the ripener ETHREL before the last two pickings can effectively promote the ripening of leaves. The preparation is very effective for low-profile tobacco. With adult leaves yellowing took place three days after application. Because yellowing continues in the curing shed, curing has to start within twelve hours of picking. If yellowing is permitted to continue any longer the leaves go brown and the quality is impaired. Restricted yellowing reduces the total curing period, with resultant fuel saving, and improves the quality. The preparation did not have a significant effect on the yield, but a high income was obtained. Various levels of nitrogenous fertiliser did not significantly influence the effect of Ethrel.

Weed control

Chemical weed control is ineffective on its own and may lead to reduced tobacco yields. Trials have shown that one cultivation combined with chemical weed control can boost the yields considerably.

Irrigation

Sprinkler irrigation combined with planting ridges is producing the best results at present. The ridges prevented waterlogging on heavy soils and made weed control and mechanisation easier. With sprinkler irrigation the irrigation intensity can be brought into line with the real water requirements. It has also been found that on turf good results are obtained when the first irrigation is delayed until four weeks or even longer after planting.

Plant feeding

In trace element trials with zinc and boron on heavy turf at Kroondal and on a light sandy soil at Nelspruit the application of these two elements held no advantages. Pot trials with a sandy soil from Sterkriver near Potgietersrus showed no boron deficiency in either limed or unlimed soil.

Diseases and pests

Black shank - *Phytophthora nicotianae* var. *nicotianae*

Although the wettable powder formulation of metalaxyl controls black shank effectively and is registered for use, the granular formulation is phytotoxic and is therefore unsuitable for use. However, the preparation will in future be marketed only as a metalaxyl/mancozeb mixture. In preliminary trials this mixture proved to have no side effects on tobacco.

Black root rot - *Thielaviopsis basicola*

For many years benomyl was the best preparation for controlling black root rot of tobacco. Two new experimental preparations, GA 64250 and GA 64251, provide better control than benomyl, however.

Black hull of groundnuts, which is also caused by a black root rot fungus, is also better controlled by the above two preparations than by benomyl.

The crops tobacco, sunn hemp, cotton, tomatoes, peppers, wheat, oats, babala, maize and buffel grass all contracted black root rot to a greater or lesser degree when planted in pre-infected soil. This is a cause for concern since these crops are normally grown with tobacco in a rotational cropping system.

Tomato spotted wilt

The tomato spotted wilt virus is transmitted by thrips on tobacco. Curaterr 10G at two g per linear metre is now registered for the control of tomato spotted wilt in oriental tobacco. About 70 per cent control can be expected.

A number of crops, varieties of tobacco and breeding lines were artificially infected with the tomato spotted wilt virus and it appears at this stage that sources of resistance may be found.

Nematodes

It was found that symptoms of phytotoxicity at a few localities, which were ascribed to the nematocide aldicarb were probably due to a boron deficiency. Preparations such as EDB, DD, Nema-cur and EDB + Vydate mixture produced relatively good control of rootknot nematode even at a very high nematode population. Curaterr produced very poor control when worked into the soil. However, when Curaterr was administered above the soil and washed in the control was far better.

Insects

Acephate wettable powder controls aphids entirely satisfactorily in tobacco. However, trials showed that if the preparation is administered in granular formulation on sandy soil it is effective against aphids far sooner than when administered on clay.

Residues

Residue results obtained with two different pyrethroids indicate that the preparations break down very little during the process of curing. This is in contrast to the results obtained with most other preparations. This property may make the preparations unsuitable for use on tobacco.

Quality

Problem tobacco

(a) Dun-coloured tobacco with a linoleum aroma

Surveys have shown that this problem occurs

in flue-cured tobacco grown on red soils. Tobacco with this deviation develops well during the growing process in the field. The problem is found mainly in the lugs that have little body. Excessive irrigation and/or rain before harvesting and over-maturity at harvesting are factors that promote the development of this deviation.

(b) Ordinary red tobacco

Trials over two seasons have shown that this problem in flue-cured tobacco is due chiefly to an excess of nitrogen at the end of the growing period and immaturity of the leaves at harvesting. Under these conditions the leaves with more body develop characteristic red spots during curing; these are due to a sponging reaction.

(c) Cherry-red tobacco

This abnormality of flue-cured tobacco is the result of a genetically linked conversion of nicotine to nornicotine during the curing process. This type of red tobacco is completely unacceptable to manufacturers as a result of the adverse effect nornicotine has on smoke quality. A plant-to-plant survey of all parent material used for seed multiplication has been started in order to eliminate plants with this genetic property.

The nicotine status of flue-cured tobacco

The results of field trials show that the nicotine content of tobacco is determined by the level of nitrogen fertilising, the time of topping and the duration of the curing period. High nitrogen fertilising, early topping and a long curing period induce a high nicotine content.

Curing

Unmarketable tobacco

In a field trial in which factors that help to make tobacco unmarketable were investigated it was found that an uneven supply of nitrogen and consequent uneven body of the leaves was responsible for 20 to 50 % of the cured tobacco classified as unmarketable.

HORTICULTURAL RESEARCH

WINTER RAINFALL AREA

APPLES

Drakenstein, the new apple cultivar

The first apple cultivar bred in South Africa was developed by the FFTRI and released under the name of Drakenstein. It is an early, red apple, with a good dessert quality. Owing to the fact that the fruit is of medium size it is recommended only for the local market, where, according to preliminary indications, it is likely to be popular.

Evaluations of apple cultivars and selections

Good progress is being made with the evaluation of apple cultivars. The cultivars Smoothee, Topred, Oregon Spur and Redchief have already been released to the industry. *Smoothee* showed slightly less russetting than standard *Golden Delicious*. *Topred* is a Starking type with a good colour. *Oregon Spur* and *Redchief* are both spur types of Starking, but according to the initial evaluation they are not as good as has been claimed in Washington. Two other very promising apples will possibly be released to the industry shortly. *Goldsmith* can be described as an early Granny Smith, although it resembles *Golden Delicious* in some ways. It ripens 2 weeks before Granny Smith and should serve as a counter to competition from early Granny Smith apples from Chili.

Golden Delicious (EMLA) is a clone that shows relatively little russetting. During the past seasons the percentage pack-out of standard *Golden Delicious* has even been below 50 % owing to russetting. This clone should therefore relieve the problem to a great extent.

In addition there are a number of early red apples for which there should be a big demand, especially on the local market. These include *Tydemans Early* (mid January), *Sweet Cornelly* (early February) and *Summerred* (mid February). *Gala* (late February) is a very attractive bright red apple with a yellow background that has been marketed very successfully in Europe through New Zealand.

The apple industry therefore has a good prospect of extending the present series of cultivars.

Factors that affect fruit size in apples

The apple industry has been experiencing unusual problems, especially during the past two seasons, with the production of fruit of too small a size. It is also clear that a larger size will have to be stipulated in future if the fruit is to compete successfully on the export market.

For the above reasons several factors capable of affecting fruit size were investigated, as was the possibility of calculating the optimum number of fruit per tree, from which the highest income could be obtained.

It appears from data obtained that the previous year's crop can significantly influence the fruit size and the number of fruit during the following year. The influence of too heavy a crop can be quantified as early as leaf drop from the percentage fertility of reproductive buds and the cell numbers in the receptacle of the developing flower truss. Reduced fertility and cell numbers are reflected in a light crop and small fruit during the following year. This information can serve as a basis during the following season for provisional

recommendations to the industry to enable producers to obtain the desired fruit size.

Fusicladium (apple scab)

The gross income from apples during the 1978/79 season was R84 million, and the annual production is 20 million cartons, which makes apples the most important kind of deciduous fruit in South Africa.

Apple scab, which is caused by the fungus *Venturia inaequalis*, is a threat to the apple industry. It is estimated that the average annual losses owing to this disease are about 4%, which amounts to about R1,33 million in monetary terms. In order to control this disease effectively, an integrated control programme was developed through intensive laboratory, glasshouse and field studies and made available to the industry. The programme functions as follows:

1. The infection potential of each orchard is determined at the end of a growing season.
2. The ascospore release pattern is determined in various apple growing areas.
The data referred to in points 1 and 2 should be used to calculate a risk index.
3. The infection periods for the various apple-growing areas are determined.
4. The judicious use of fungicides - i.e. from the beginning of the spraying season - should be followed by a basic protective programme. Curative treatment should only be applied to supplement or support the protective programme, where necessary.
5. Regular orchard inspections should be carried out during the entire growing season and control measures applied in accordance with prevailing conditions.

Snout beetles on apples

After the prohibition of the use of DDT snout beetles became a major pest. During that period they caused damage to up to 40% of the apple crop.

A high degree of success has since been achieved in the effective and economical chemical management of snout beetles on apples. This insecticide controlled snout beetles to such an extent when it was used against codling moth that the former had no pest status. During recent years the use of acephate and four synthetic pyrethroids, permethrin, cypermethrin, deltamethrin and fenvalerate, was developed for snout beetle control on apples. The timing of spraying with these insecticides was regulated to coincide with their application against codling moth and bollworm. An integrated pest management programme was therefore achieved for snout beetles on apples.

Core rot in apples

Core rot is caused by a variety of organisms that infect apples during the full flowering stage or shortly afterwards. It is an important post-harvest

malady because the consumer is usually the first to see it and the result may be that consumers become wary of the product.

It has been proved that the open calyx tube of Starking is not the primary factor that makes this cultivar so exceptionally susceptible to core rot. An important breakthrough in research on core rot was the discovery that the low acid content may be the reason why Starking develops more core rot than Granny Smith, which has a high acid content. The acid content and pH have a significant effect on the germination of *Alternaria alternata* conidia. This finding is a contribution to a better understanding of the etiology of core rot, which is essential for the development of control measures.

Ripeness index for apples

The ripeness of an apple determines not only its eating quality but also its storage life. Apples should therefore be harvested at the correct degree of ripeness in order to enable producers to market apples of a high quality. It should also be possible to predict the optimum picking date because decisions with regard to the eventual destination of the fruit have to be taken prior to harvesting. For this reason trials were carried out to determine what the optimum harvesting date would be in terms of ripeness indices such as sugar content, starch content and firmness and whether this date can be predicted. It was established that acid content, pip colour and total soluble solids content (sugar content) are reliable ripeness indices that change according to a predictable pattern. By measuring these indices in the orchard, producers can determine the optimum harvesting date two weeks in advance. This makes it possible to arrange the harvesting programme in an orderly fashion and decide which fruit is suitable for long-term storage and which is not. In this way the harvesting of unripe or overripe fruit is eliminated and only high quality apples reach the market.

Bruising in Golden Delicious apples

Golden Delicious, which fetched the highest prices during the past season, bruises the most easily of all the cultivars grown commercially at present and as a result large quantities of apples are rejected each year as being unsuitable for export. Rejections may occasionally be as high as 5 000 cartons a day, and this represents a loss of over R30 000. It was a known fact that most apples bruise during handling in the store and the points where the most bruising takes place were identified. During this season methods of protecting apples against bruising at these points were investigated. It was found that bruising can be greatly reduced if the risk areas on the grader and sorting belt are covered with 5 mm thick high-density sponge. Where the distance the apples fall exceeds 35 mm, 10 mm thick sponge should be used. This finding has already been applied by a store and the result was that considerably fewer apples were rejected for bruising.

Controlled atmosphere storage of apples

The profitability of the apple industry depends largely on successful marketing over a long period. With conventional storage methods, namely a temperature of $-0,5^{\circ}\text{C}$ and a relative humidity of 90 %, the present apple cultivars cannot be stored long enough for marketing to take place according to a logical pattern. The storage life of the most important cultivars (Golden Delicious, Granny Smith and Starking) can be considerably extended through controlled atmosphere (CA) storage. During CA storage the oxygen (O_2) concentration is reduced and the carbon dioxide (CO_2) concentration increased at a temperature of $-0,5^{\circ}\text{C}$ and a high relative humidity. However, the optimum gas concentrations differ from one cultivar to another and trials have been carried out to determine the ideal combination for each cultivar. It has been found that 3 % O_2 and 3 % CO_2 is ideal for Golden Delicious and Starking, whereas 3 % O_2 and 0 % CO_2 is ideal for Granny Smith. This technique extends the storage life by three months or more. The findings are very important to the apple industry and are being applied on an increasing scale. Fresh, high quality apples are available virtually throughout the year at present and both the producer and the consumer reap the benefits.

DRUPES

Bacterial spot *Xanthomonas campestris* pv. *pruni*

At present bacterial spot is a serious production limiting factor in the cultivation of all drupes, especially in the winter rainfall area. It is estimated that the drupe industry loses about 5 % of production directly or indirectly each year, which represents a loss of about R4 million.

It was found during the 1979/80 season that the pathogen can survive in apparently healthy axils. Axils on one-year-old shoots showed up to 4 % latent infection. Axils with latent infections are creating a serious problem at present, in that nurseries spread the disease to disease-free areas in this way. These findings are compelling nurseries to collect propagating material in areas where bacterial spot does not occur. Research on the elimination of the bacterium by means of hot water treatment is being carried out.

Crown gall *Agrobacterium tumefaciens*

Crown gall creates problems annually in all the nurseries in South Africa. It is very common in peaches in the winter rainfall area and the Transvaal, in cherries in the OFS and in vines in the De Doorns and Lower Orange River areas. Although crown gall can be fairly effectively controlled by biological means, 100 % control cannot be obtained in all cases.

Research has shown that 30 % of the crown gall pathogens from cherries, plums, grapevines and ornamentals that were investigated showed resistance to biological control by *A. radiobacter* Race 84 on tomato plants.

The high percentage of race 84 resistant crown gall pathogens isolated mainly from drupes and grapevines indicates that it will not be possible to control crown gall in South Africa through race 84 alone. It is to be hoped that new techniques of control or bacterial races capable of providing more complete control of all crown gall biotypes will soon be found.

PEARS

Evaluation of pear rootstocks and cultivars

Rootstocks: Seedling rootstocks are mainly used in the local industry. In the course of trials carried out over a number of years it was found that the new BP clone rootstocks released to the industry, namely BP1, BP2 and BP3, do far better than trees on seedlings. With the best rootstock, namely BP3, up to 30 % higher production is obtained than with trees planted on seedlings.

BP3, which is the strongest rootstock, is already virus-free and is recommended for poorer soils especially. BP1 is also virus-free and yields a tree about 75 % of the size of a tree on a seedling rootstock; it is therefore recommended for good soils and high density plantings.

Although BP2 is considerably better than a seedling pear, it is not strongly recommended because it is not virus free and the difference between BP1 and BP3 is too slight to justify a third rootstock. The Quince-A rootstock is regarded as too dwarfing for most South Africa soils.

Cultivars: Good progress has recently been made with the evaluation of pear cultivars. Prices for pears are very good overseas and South African pears, especially Packham's Triumph, are very popular. Because Packham's Triumph already constitutes 53 % of pear exports, this causes a peak period in respect of harvesting and packing. There is consequently a need for earlier and later cultivars of the same high quality.

During the past season *El Dorado*, a pear cultivar with the same properties but larger fruit, better productivity and far lower cold requirements than Bon Chrétien, was released to the industry. In addition *Ceres*, which ripens two weeks before Packham's Triumph and has the same good keeping quality, is in the final stage of evaluation. There is also an attractive red mutation of Clapp's Favourite, *Starcrimson*, which holds considerable promise.

Breeding of improved cultivars

From over 18 000 pear seedlings already established in orchards, 105 were identified for a further phase 1 evaluation and 10 of these were provisionally selected.

PEACHES

Evaluation of peach and nectarine cultivars

Very good progress was made in respect of dessert peaches and nectarines. The peaches *Desert Gold* (beginning of November) and *Fairtime* (beginning of March) were released for the local market. *Springcrest* stores well and was also released as a possible export peach. *Desert Gold* is a very attractive and palatable yellow-fleshed type with a semi-loose stone. The fruit tends to be on the small side and therefore requires very careful thinning. *Fairtime* is a large, attractive, yellow-fleshed, loosestone peach which does not, however, store or dry well. *Springcrest* is a very attractive yellow-fleshed peach and stores well so that it should also be suitable for the export market.

Four yellow-fleshed nectarine cultivars were released. *Sunlite*, which ripens at the beginning of December, has a low cold requirement. It is very attractive, stores fairly well to well and should do well on the export market. *Early Sungrand* has a high cold requirement; its fruit ripens from the middle to the end of December and it is a very attractive peach with good eatability. It stores very well and has a long shelf life. *Stark Sunglo* has high cold requirements; its fruit ripens in the middle of January, and stores fairly well and dries well. This cultivar should therefore be very popular in the cold areas. *Nectar 9* has a medium cold requirement, ripens at the beginning of February, and is very attractive and palatable. Because it stores well it should be acceptable for export.

When these nectarines are added to the existing cultivars, South Africa has a series that ripens virtually continuously from the beginning of December to February.

Breeding improved cultivars

Of the F_2 populations developed in order to breed yellow-fleshed clingstone canning peach cultivars with sturdy frame branches, 158 were provisionally selected. The dessert peach breeding section produced 40 promising yellow-fleshed dessert peaches and nectarines, which will undergo further evaluation under phase 2. A few selections were also found to be suitable for drying.

PLUMS

Breeding of improved plum cultivars

Progress with breeding for resistance to bacterial spot has been good and of the 46 selections recommended for phase 2 evaluation so far, a few should be in bearing next season.

Evaluation of plum cultivars

The plum industry is expanding very rapidly at present, but the available cultivars ripen over a very short period, which causes a sharp peak in the

harvesting and marketing season. There is therefore a special need for cultivars that are harvested before or after January.

A promising early cultivar *Frontier*, that bears large, dark red plums of good quality and ripens at the same time as Santa Rosa, is being considered for release at present.

Evaluation of rootstocks for plums

Plums are being planted on a very large scale at present, frequently on poor or problem soils, with the result that deaths among plum trees have become a pressing problem in the industry. There is therefore a great need for rootstocks capable of adapting to various types of soil. The evaluation of plum rootstocks is therefore being given high priority.

From data obtained so far at the Bien Donn  Experimental Farm, it appears that virus-free *Marianna*, *Nemaguard* and *Okinawa*, but especially *Marianna*, can be recommended as rootstocks for plums on the grounds of their production efficiency and fruit size. Because *Marianna* is more resistant to wet conditions it is the first choice. *Kakamas* and *Du Plessis* can be considered for Santa Rosa in addition to the three rootstocks mentioned above. *Myrobalan B* and *Prunus mume* cannot be recommended.

The commercial application of this information could ensure a more prosperous plum industry.

APRICOTS

Breeding of improved cultivars

The ideal of breeding dual-purpose cultivars suitable for both canning and drying is rapidly being realised. A few promising selections that hold great promise in regard to both properties have already been identified and will shortly be multiplied for further evaluation.

Evaluation of rootstocks for apricots

The choice of suitable rootstocks for apricots remains a major problem because apricots are very prone to affinity problems. Apricots are often planted on rather poor or problem soils, with the result that the adaptability of the rootstock is extremely important.

It is clear from results obtained on the Robertson Experimental Farm that on the basis of production efficiency there are no differences between virus-free *Marianna* cutting, *Nemaguard* seedling and apricot seedling as rootstocks for Royal. In most cases the choice will be determined by the soil.

For Bulida and Peek, apricot seedling is still the rootstock that can be recommended with confidence. Certain plum crossings that proved compatible with the above cultivars under experimental conditions have potential for use on problem soils, however.

TABLE GRAPES

Nutrient reserves in table grapes

A study on the consumption of nutrient reserves during vegetative propagation of the grapevine and related factors has been completed. Results show the importance of sugar and starch reserves during root and callus formation in cuttings. For instance, the rootstock cutting rooted in the nursery is dependent on carbohydrate reserves for the one or two weeks before the production of carbohydrates by the leaves starts exceeding consumption.

This study is among the most comprehensive carried out in this direction so far. The knowledge can be utilised by nurserymen since it provides a guide for determining correct practices with a view to optimum reserve status.

Breeding of improved cultivars

Of the close to 16 000 seedlings worked over onto established rootstocks since 1976, 97 promising selections have so far been identified, 85 of which are in phase 1, 6 in phase 2 and 6 in phase 3 evaluation. Prospects of releasing new and improved cultivars to the industry from among the latter appear very promising.

Botrytis spoiling in table grapes

Botrytis cinerea is an important disease of table grapes and causes annual export losses of 3 to 4 %. If one takes into account the fact that about 7 million cartons of grapes to the value of about R62 million were exported during the 1979/80 season, it will be realised that the table grape industry loses up to R2,5 million annually because of this disease. The fact that grapes that appear healthy upon packing are rotted by the fungus during transportation makes the disease more serious. The disease should therefore be controlled during both the pre- and post-harvesting periods.

The incidence of *B. cinerea* was again severe during the past season, especially in late table grape cultivars. An investigation of the factors that affect the survival of the fungus in infected pruning has shown that where weeds are sprayed with a weed-killer the survival period of the fungus is considerably shorter than where weeds are controlled by ploughing them in.

It has been established that *Botrytis* affects grapes to a serious degree only late in the season. Disease control is not adequate because producers are obliged to use less effective dusting powders late in the season because sprays at the stage would cause a visible precipitate on the fruit. Such fruit is unacceptable for export.

Control of the vine mealybug

The vine mealybug has been the most important pest of table grapes for the past 40 years. Outstanding success has been achieved since

1978 with the chemical management of vine mealybug in table grapes. The development of the use of prothiophos and chlorpyrifos in specific programmes on early, midseason and late table grape cultivars has been completed. Depending on the vine mealybug infection pressure and the earliness or lateness of the cultivar, a standard programme cannot provide better than 90-95 % control. Under similar conditions, however, a chlorpyrifos programme can provide 97 to 98 % control and a prothiophos programme as much as 98 to over 99 % control. The most effective and economical chemical control ever of vine mealybug, the most important pest of table grapes, has now been achieved.

Sulphur dioxide release at various temperatures

The sulphur dioxide gas sheet used in polyethylene bag packs to control *Botrytis cinerea* rot during storage is very effective. The rate at which sulphur dioxide is released is occasionally too high and harmful concentrations then build up in the bag. Research has shown that this disadvantage can be eliminated by pre-cooling the grapes to 10 °C or less. This practice is not yet being applied but the results are so promising that it has been the reason, together with other quality benefits from rapid cooling, for the construction of commercial table grape cool rooms in the Hex River Valley. Similar applications are being considered in the Paarl area.

TECHNOLOGY

Processing of dates

Dates are being successfully grown on a limited scale in the North-Western Cape. However, a large proportion of these dates are light-coloured, hard or bread dates. The possibility of processing such dates into products suitable for use in baking is being investigated in co-operation with the Department of Food Science of the University of Stellenbosch. A steam treatment for one hour at a relatively high temperature after the dates have been stoned has been found to produce soft, dark-coloured dates. These dates were used in several types of baking and compared very well with the imported product.

ROOIBOS TEA

Cultivation of rooibos tea

The indigenous rooibos tea plant *Aspalathus linearis* is found in its natural state on the slopes of mountains, especially the Cedarberg and Olifants River ranges near Clanwilliam and Citrusdal. Only the selected rooibos tea type is cultivated and processed today, and the cultivation of this crop is increasing in the higher lying parts of the recognised production areas.

If the full production potential of rooibos tea is to be developed, greater production stability in

the industry will be needed. Knowledge of correct and scientifically based cultivation and harvesting methods is still inadequate. In view of this attention is given to the period and intensity of harvesting, its effect on the reserve status of the bush, and to the effect of fertilising on the performance and life of the bush.

Certain deductions can already be drawn from results collected over only two years. It has been found that phosphate applications bring about an increase in the mass of tea harvested but that very high applications can have toxic effects. Bushes harvested monthly or every second month produce considerably lower tea yields than those harvested once or twice a year. Bushes harvested in November or May are more subject to diseases than where other harvesting treatments are applied, but diseases occur with all harvesting treatments, mainly as a result of fungus infection. Preliminary results show that the rooibos tea plant does not appear to store large quantities of starch and that it has to depend largely on current photosynthesis for its energy needs. The presence of enough healthy leaves, especially during the period of very active growth, is therefore essential.

GRANADILLAS

The demand for granadillas has increased a great deal over the past few years, especially at canning factories. Average factory prices are R350 per ton, and granadillas fetch 60c tot R1,20 per kg on the fresh market. However, this market is limited, although the Deciduous Fruit Board is interested in exporting fresh granadillas.

In trial plantings at Bien Donn , yields of 6 tons/ha in the first year after planting, 19 tons/ha in the second year after planting and 24 tons/ha in the 3rd year after planting were attained. It is expected to be possible to maintain a production of about 25 tons per ha for 6-10 years, which makes granadillas a highly profitable crop. Harvesting takes place in January and requires relatively little labour. The establishment costs of granadillas are estimated at R6 300 per ha, but complete production costs are not known.

SUPPORTING RESEARCH

Radioisotopy

Determining soil moisture and density with the aid of gamma attenuation

The particle size composition of a soil has important implications in respect of the moisture retaining capacity and ion adsorption and compaction of the soil. This parameter is therefore of importance in irrigation scheduling and in fertilising, especially when fertilisers are applied in the irrigation water. It is also important in the choice of suitable tillage practices.

Particles of different sizes have different rates of fall when suspended in water. Therefore, by determining the density of a suspension of that kind at various times one can deduce what the

particle size composition of the soil is. Conventionally the density of the suspension is determined by immersing a hydrometer in it. However, this impedes the free fall of particles and the method is also very time consuming. If the hydrometer method is used, it takes 9 hours to determine the clay content of a single soil sample.

However, the density of the soil suspension can now also be determined by determining the attenuation of gamma rays through the soil suspension. Excellent results have been achieved with this new method. The advantages are that the suspension is not disturbed in any way and the determination of the clay content of a soil sample can be carried out within a single hour. This new method can help a great deal to speed up soil analysis in routine analysis laboratories.

SUMMER RAINFALL AREA PEACHES

Breeding

At Roodeplaat the past season was a very good one for peaches. Yield, fruit size and fruit quality were outstanding. Five peach seedlings appeared promising in the breeding programme - so promising in fact that these selections will be commercially evaluated by producers immediately. The selections were:

(a) Canning type

The selection SE 13 ripened about a month earlier than Oom Sarel. Although the seedling was planted in fairly poor soil, the tree nevertheless produced a good crop of fairly large fruit (110 g). This peach will be evaluated as a dessert and canning type.

(b) Dessert types

Two seedlings produced very attractive peaches of a good quality. Selection 75-422 bore a very good crop of extremely attractive peaches for the second successive year. This is a yellow-fleshed, semi-cling peach that ripens early in November.

Selection 76-213 was also very promising for the second successive year. This seedling bears very well and the fruit are exceptionally big (200 g). It is a yellow-fleshed, loosestone peach with a good keeping quality and a flavour reminiscent of Elberta. This is possibly the best dessert peach selection available at Roodeplaat at present.

(c) Nectarine types

Two selections were extremely promising. Selection 77-2 ripened immediately before Christmas; the fruit was very big (140 g), yellow with a loose stone, well rounded and very attractive. Selection 75-288 is slightly larger than selection 77-2, oval in shape and ripens at the end of December. This selection has a good keeping quality. Five weeks after storage at 5°C the fruit was still in excellent edible condition.

TABLE GRAPES

The breeding programme undertaken for the summer rainfall area by the Department of Lands in 1954 has led to the release over the past 15 years of a number of cultivars that can be grown with success in this area. In the Warmbaths and Nylstroom areas there is unprecedented interest in the cultivation of table grapes.

This year the Waterberg Table Grape Producers' Association again made arrangements to supply 120 000 grafted vines to their members. As a result of the good showing Ronelle made at Roodeplaat over the past few years about 50 000 vines of this cultivar are being planted this year. Bien Donné, which is also very resistant to cracking, is also being planted on a large scale. The indications are that about the same number of vines have already been ordered for next year.

The biggest problem table-grape producers have to deal with in the summer rainfall area is berry cracking. The following selections were the most promising this year in respect of resistance to cracking and fruit quality.

- *Q/DM 69-1397*

This is a white grape that ripens at the end of December. The berries are large (7,5 g), round and very resistant to cracking. A big advantage of the selection is that the bunches are loose.

- *HD X HD/AL 70-3615*

This is a very promising white grape which has a muscat aroma and ripens early in January. The berries are fairly large (6,5 g) and of even size. The bunches are very well filled. The preliminary indications are that the selection can also be dried. No berry cracking occurred in this selection this year.

- *K/WC 70-4775*

This breeding line again appeared very promising. This is an attractive rose-coloured grape that ripens at the end of January. No berry cracking occurred.

- *AL/BAR 70-273*

This black selection again proved to be a very promising mid-season (end of December) grape this year. The berries are considerably larger (8,2 g) and far better coloured than those of Barlinka. No berry cracking occurred this year.

- *Bl6/32*

This white Bien Donné selection which ripens in March is a very promising late selection. The bunches are slightly dense but are nevertheless attractive. The berries are oval, large (7,5 g) and resistant to cracking.

VITICULTURE

Fertilising

After seven seasons of differential fertilising this trial is starting to produce interesting results. No clear pattern was to be seen during the first six years but it is now clearly apparent that the vines respond positively to both N and K fertilising in respect of yield. However, there has as yet been no response to P fertilising. Wine made from grapes from plots that received no fertilising was of a poorer quality. This cannot be linked to a slower fermentation rate or to the incidence of rot.

Irrigation and cultivation

At the end of the second season during which various treatments were applied, it was clear that Wimmera can be successfully used as a cover crop at Oudtshoorn. Contact herbicides are not suitable for killing a dense stand of cover crop, owing to the protective effect of the dense plant mass. The cultivation treatments have only affected shoot growth so far, with clean cultivation producing significantly better results than were obtained on plots where vetches were planted as the cover crop. This result can probably be ascribed to the difficulty experienced in obtaining an adequate stand of vetches and the consequent poorer water penetration.

Among the irrigation treatments, irrigation in furrows resulted in significantly poorer grape production and shoot growth, higher sugar and lower acid content and pH than full surface cover irrigation. This may be ascribed to the fact that the furrows received only 403 mm of irrigation water in comparison with the 876 mm and 1 024 mm applied to the beds. If the irrigation scheduling is adapted for the furrows, a considerable saving on water should be achieved, and production and shoot growth should be closer to the results obtained with bed irrigation. Irrigation scheduling on the basis of the growth stage of the vines resulted in a saving of 148 mm on irrigation water without impairing the production, growth or quality.

Soil preparation

Trenching was more effective than subsoiling and where soils were prepared to a greater depth the root systems were deeper. The study showed that large clods form during soil preparation; they may constitute up to 40 % of the soil volume and they reduce the efficiency of the preparation. In soils of this kind criss-cross delving should therefore be applied in order to put the entire soil volume at the disposal of the vine.

Renovation of old vineyards

Wood rot in vines as a result of the penetration of fungi through pruning wounds is a serious problem in many vineyards in the Western Cape. The possibility of renovating a vineyard that has been severely attacked by wood rot was

investigated. Vines were sawed down or girdled to stimulate budding of water shoots that could later develop into new stems, or the old stems were grafted by means of T-budding. No significant differences between the three methods were found and in all cases the survival percentage was too low to make the top-working of vineyards performing badly on account of wood rot economically justified.

Mechanical harvesting of wine grapes

It appears from preliminary results that the Extended Perold and T crossbar Perold trellising systems produce the lowest crop losses and the least damage to the vines and are probably the ideal systems for mechanical harvesting on the horizontal beater principle.

Trellising and planting width

In a trial in which four vine spacings in the row, with a constant row width and two trellis sizes, were evaluated with Colombar vines in the Orange River area, it was found that although the crop per vine increases with increasing planting widths, the crop per ha decreases. Trellis size had virtually no effect on the size of the crop or the shoot mass. According to current results planting widths greater than 4 m x 1,3 m cannot be recommended for Colombar.

Effect of trellising on Chenin blanc

The effect of the trellising system (bush-trained vines, Perold, extended Perold and slanting trellis) on water consumption, rotting, microclimate and grape and wine composition was investigated with Chenin blanc vines at Robertson.

The slanting trellis system has significantly more roots than the other three systems, but there was no connection between root density and the rate of water consumption.

Rot was commoner in the bush-trained vines than in the higher systems, partly owing to the higher N content of the bush-trained vines.

Contrary to expectations the sugar concentration in the berries was lower in bush-trained vines than in trellised vines, even after grapes from the bush-trained vines had been left on the vines for eight days longer than the grapes had been left on the trellised vines. Continued growth of the bush-trained vines may be responsible for this.

Pruning of Cabernet Sauvignon

Budding percentage is the biggest single factor that affects the size of the crop of the cultivar Cabernet Sauvignon. A study was undertaken to find a pruning method that would result in the highest possible budding percentage for this cultivar.

The results of the trial show that, in contrast to the general belief, Cabernet Sauvignon is fertile at the basal eyes and since the budding percentage

of spurs is considerably higher than that of long bearers, comparable and even higher production is obtained with spurs. The latter pruning method is considerably easier to apply in practice than any long cane pruning method and if a comparable number of bearer eyes per vine can be allocated, it is recommended that this pruning method should be used for Cabernet Sauvignon.

Suckering of Chenin blanc

The effect of suckering on the performance of the vine, the incidence of disease and the economics of pruning and harvesting was investigated. The results of the trial show that the vine largely compensates for the vegetative growth and bunches that are removed during suckering. No significant differences in growth and bearing performance could be found between the four treatments, which differed from each other in respect of how severely suckering was applied, and the control, and it was established that the differences that were found could be ascribed mainly to differences in fertility. On the other hand the severer suckering treatment saved a great deal of labour during pruning. Although the long-term effect of suckering with regard to this trial has still to be established, it is already apparent that sensible suckering treatments can only be to the benefit of the vine.

DISEASES AND PESTS OF VINES

Control of Snails

Several chemical preparations for the control of snails were applied in field trials. Chlorpyrifos 48 % extract at 75 g/100 l of water and acephate 75 % solution at 75 g/100 l of water produced very poor control of the brown snail *Helix aspersa*. Methiocarb 80 % wp at 100 g/100 l of water, bendiocarb 80 % wp at 100 g/100 l of water and lime plus copper sulphate (10:1) at 50 kg/ha produced promising results, however.

Poor control of the dune snail *Theba pisana* was obtained with lime plus copper sulphate (10:1) at 50 kg/ha, bendiocarb 80 % wp at 100 g/100 l of water and monocrotophos 40 % extract at 250 ml/100 l of water. Methiocarb 80 % wp at 100 g/100 l of water and oxamyl 45,5 % sol. at 416 ml/100 l of water produced promising results.

Although promising results were obtained, some of the preparations are very expensive and further trials to find economical means of controlling snails are planned.

Resistance of rootstocks to Phylloxera

An *in vitro* method by which the resistance to phylloxera of new rootstock cultivars can be determined rapidly was investigated. It was found that the method can be applied as a fast screening process to eliminate rootstock cultivars with insufficient resistance to phylloxera to be included in long-term field trials. On the basis of the results

obtained, the following cultivars can be provisionally divided into five classes of resistance:

Immune:	Castel 216/3; 140 Ruggeri; 3/6; 3/5; 8/7; 5BB; 26G; Prosperi Super Richter
Very good:	125C; 161/49C; 1103 Paulsen; 99 Richter; 1447 Paulsen; SO4
Good:	Maléque 150/15; 2/1; 1045 Paulsen; 775 Paulsen; Salt Creek
Poor:	Jacquez
Very poor:	Chenin Blanc; Carignan Blanc x Ganzin No. 2

Chemical control of phylloxera

The possibility of controlling phylloxera chemically in existing vineyards and at the planting of young vines was investigated. On the grounds of previous experience, hexachlorobutadine was used as a soil fumigant. The results showed that the preparation is able to control phylloxera for periods of up to five years in existing vineyards, but that it is phytotoxic to the vine.

Control of beetles

Several insecticides were compared in field trials for their control of the most important species of beetle in vineyards, *Eremnus cerealis*. Acephate (75 % wp) at concentrations of 50 and 75 g/100l of water was very effective, but carbaryl at 125 g/100l was less effective. Three synthetic pyrethroids, permethrin, cypermethrin and fenvalerate, were very effective in controlling this species of beetle in vines.

Chemical control of *Phytophthora cinnamomi*

Field trials showed that Ridomil administered as a soil preparation can control *Phytophthora cinnamomi* on vines in the nursery. The preparation does not kill the fungus, but it retards growth and suppresses spore formation. The development of the fungus in plants that are already infected is also suppressed. In the soil the action of the preparation is effective for six weeks and four applications at various stages of the season should keep the population on a susceptible rootstock such as Richter 99 very low. This treatment, combined with a hot water treatment, could therefore prevent the fungus from spreading through the nursery material.

Apoplexy in vines

The investigation of the organisms responsible for woodrot of vines, a condition known as apoplexy, was continued. Ten fungi that

are regularly isolated from the pruning wounds of vines infected with apoplexy were identified. Reinfection of healthy material with the various fungal species individual did not cause the typical symptoms of apoplexy, although some degree of woodrot occurred. Indications were found that specific combinations of fungi are necessary to cause the symptoms of apoplexy.

Further studies showed that the fungal species differ drastically in their sensitivity to various existing fungicides and that a combination of fungicides would be required to protect pruning wounds effectively against infection by the fungi.

OENOLOGY

The maturation of wine

It was found last year that the full maturation bouquet that develops in wine is undesirable in dry white wines in many cases. As a result the study was repeated with wines containing residual sugar.

Although the changes in the wines stored at various temperatures were almost identical for dry white wines and white wines with residual sugar, it was clear that the latter were better balanced. When the dry wines developed too prominent a bottle bouquet, balance presented problems. It was also established that white wines containing residual sugar were still good after storage at 20 °C for 18 months. When dry white wines were stored at the same temperature for the same period there was a drop in wine quality after 8 months.

Chemical aspects of the products of the vine

In an attempt to check analytical methods that have to be applied internationally and eliminate problems in connection with them, the analysis of three wines in respect of alcohol, relative density, sugar concentration, total acid and volatile acid concentrations was checked in collaboration with 12 other member countries of the International Wine Office (OIV).

If the analyses are recommended by the OIV they will probably be adopted by EEC countries and other wine-producing and consumer countries.

The effect of the composition of the must on fermentation and wine quality

It has been established that -aminonitrogen and total nitrogen concentrations amount to 138 and 435 mg/l (average) for the whole industry. Musts made of Clairette blanche and French groups and musts from Robertson and the Little Karoo areas had considerably lower nitrogen concentrations than the average values for the 1980 season. In general South African musts in 1980 contained sufficient nitrogen for the completion of fermentation.

Problems with retarded fermentation at a co-operative winery could clearly be ascribed to the

inefficient use of selected yeast. Musts that fermented for long periods had a low quantity of live yeast cells with a low ergosterol concentration at the start of the fermentation. Research and extension should therefore be directed at the correct method of selected yeast preparation.

Fermentation rate is affected most by the percentage of lees in the must, but wine quality is reduced by high concentrations of lees. The addition of nitrogen to must accelerated the fermentation rate and improved the wine quality. An increase in the concentration of lees did not impair the wine quality, however, if nitrogen was added to the must. This practice appears to be the most desirable for reducing retarded fermentation while retaining wine quality.

Identification and evaluation of malolactic acid bacteria in S.A. red wines

Five malolactic acid bacteria were inoculated into Cabernet Sauvignon wine in order to evaluate the effect of the bacteria on the wine quality. Two overseas races, namely Equilait and *Leuconostoc oenos* ML34 and three local isolates, namely *Leuconostoc oenos* Ca3, *Leuconostoc oenos* Ta8 and a *Lactobacillus* isolate Gb1, were used. Preliminary results show no significant differences between the isolates in regard to quality. The experiment is being continued.

Routine microbiological analyses and investigations

Eighty problem cases were dealt with during the past year. Eleven of these were analyses to determine microbiological stability and were carried out on behalf of the Wine and Spirit Board. In addition 170 malic acid determinations (paper-chromatographic) and 160 and 100 sterility tests for the presence of yeasts and bacteria, respectively, were carried out.

The increase of 70 per cent in the number of analyses of red wines for the problem of malolactic acid fermentation and a far bigger increase in the number of analyses of semi-sweet wines for yeast are evidence of the concern these two problems are causing the industry.

Effect of temperature on fermentation and yeast metabolism

Gewürztraminer, Chenin blanc and Colombar wines were made during the 1980 vintage, as during the previous year. Gewürztraminer produced the best wines, and Colombar was used for distilling wine after sticking at 4 - 5 g/l of sugar. The Gewürztraminer and Chenin blanc wines were subjected to organoleptic judging, and it was found that the wines that fermented at 15°C and those that started at 15°C and completed the fermentation at 25°C were of the best quality. Wines that fermented at 25°C were significantly

poorer than any of the others. This trial will be repeated during the 1981 vintage, since retarded fermentation had a major effect on wine quality.

Efficient use of dried wine yeast in wine making

For the past two years South African dried wine yeast has complied with international requirements in respect of live yeast cell count and fungal and bacterial counts. The only exception was the race Epernay, which was not released in 1980 because the yeast counts were too low.

In 1979 researchers concentrated mainly on initial slowness of fermentations with dried yeast and petite colony formation and ergosterol production were investigated. It was found that there is undoubtedly a connection between capacity to form ergosterol and duration of the fermentation.

In 1980 the emphasis was placed on ergosterol production and the experiments were extended to yeasts from the OVRI collection. Ten of these yeast races were tested in respect of their capacity to form ergosterol and marked differences between the races were found.

The dry yeast races WE14 and 228 were also used for the multiplication of yeast in must that was continuously aerated. The results show that this selected yeast had far higher cell counts and a far higher ergosterol content upon inoculation than selected yeast that had not been aerated and fermentations were also completed far faster. It therefore appears that aeration of selected yeast would cut down on retarded fermentation.

Malolactic acid fermentation in South African red wines

Malolactic acid fermentation (MLF) was induced in wines with the aid of two different *Lactobacillus* cultures, viz a locally isolated homofermentative culture and a French commercial culture, Equilait. A carbonic acid maceration medium (spontaneous culture) was also used for inoculation. The stage of inoculation did not affect the wine quality with the Equilait treatments. At a low pH level no loss of cultivar character was found in wines, but losses increased at higher pH values. The only wines in which off flavours were detected were those inoculated with the carbonic acid gas maceration medium. The other two bacterial species produced wines of better quality and it appears that the locally isolated homofermentative culture produced the best wines. The differences in wine quality observed between the bacterial cultures increased with the maturation of the wine. The pH of the wine had no significant effect on wine quality after MLF, not even after one year of bottle maturation.

Liquor control

Wine certification scheme under Act 25 of 1957

Table 1 contains a summary of the quantities of wine certified for sale by the Wine and Spirit Board, with indications of origin, estate, vintage or cultivar.

TABLE 1 - Certification of wines of origin and vintage and/or cultivar wines

Type of wine	Total Certified	Superior quality		Special quality	
	hℓ	hℓ	%	hℓ	%
Natural wines	196 940	17 308	8,8	179 632	91,2
Liqueur wines and other fortified wines	48 240	5 391	11,2	42 849	88,8
Total	245 180	22 699	9,3	222 481	90,7

According to the figures given in Table 1 the volume of natural wine constitutes 80 % of the total volume of wine certified. Furthermore, the volume of natural wine certified during 1980 constitutes 9,2 % of total sales (domestic sales plus exports) of natural wine, as against the 10,3 % for 1979.

Inspection of rebate wine, rebate brandy, wine spirits and grape spirits

Table 2 contains a summary of the inspection for quality by the Government Brandy Board of wine intended for distilling into rebate brandy and for the certification of such distillates, and of wine spirits for the manufacture of brandy and other alcoholic beverages.

TABLE 2 - Certification of rebate wine, rebate brandy, grape spirits and wine spirits

	Total samples inspected	Approved		rejected by volume
	hℓ	hℓ	%	
Rebate wine	144	91 684	91 684	None
Rebate brandy	381	104 034	102 635	1,34
Wine spirits	719	304 087	298 751	1,79
Grape spirits	43	24 189	189 373	21,71
Low strength spirits	231	109 329	108 512	0,75
Spirits for vinegar	3	2 080	2 080	None

Control of export liquor in terms of the export regulations under Act 25 of 1957

A total of 3 242 samples, representing a total volume of 113 144 hℓ, of wine and spirits intended for export were inspected on a quality basis and chemically analysed by the Wine and Spirit Board during 1980. Of this volume 113 050 hℓ was approved for export.

During 1980 there was an increase of 26,4 % in total exports of wine and spirits, with bottled exports representing an increase of 36,5 % and bulk exports an increase of 18 %. Bottled exports now constitute 49,0 % of total exports.

Control of imported liquor

Control of all imported liquor, in co-operation with the Directorate of Customs and Excise of the Department of Finance, to ensure that it complies with the requirements of Act 25 of 1957, resulted in the chemical analysis of 2 602 samples of liquor by the routine analysis laboratory of the OVRI. In addition the samples were inspected for labelling. A total of 81 samples of liquor were rejected owing to failure of one kind or another to comply with the provisions of the Act.

Local liquor inspections

Three liquor inspectors who are responsible in terms of Act 25 of 1957 for the inspection of all licensed liquor manufacturing and sales premises in the Republic carried out surprise inspections at a total of 1 669 premises in the Republic during 1980.

These inspections led to two court cases, one of which is still pending and the other of which was decided in favour of the accused. Ten importers and wholesalers were cautioned.

Wine control for certification

Up to 1 August 1980 control of wine for certification at the premises of the KWV was undertaken by two wine controllers. On this date control was taken over by the Department at four wholesale premises. To make provision for the additional work one extra wine controller was appointed and two of the liquor inspectors assisted while the premises were being taken over.

Routine analysis services

The routine analysis laboratory of the OVRI carried out the chemical analysis of a total of 18 949 liquor samples during 1980. This service is used for the analysis of all alcoholic beverages, including wines for certification and export and import liquor, which have to be analysed under Act 25 of 1957 in order to determine whether they comply with legal requirements for composition, before they may be sold. This laboratory also undertakes all routine analyses of experimental wines made by the OVRI, and 5 094 samples were analysed during 1980.

This laboratory is also the only official centre of the analysis of liquor on behalf of other Government departments, such as the Departments of Police and Customs and Excise.

SUBTROPICAL FRUIT CITRUS

Experimental work under various ecological conditions

The diverse requirements of the various citrus varieties in respect of soil, climate and height above sea level compel the Citrus and Subtropical Fruit Research Institute to carry out experimental work under a wide range of ecological conditions.

Although the basic work is done mainly at Nelspruit, the application of knowledge takes place over a representative spectrum of citrus producing areas throughout the country.

Field work is at present being carried out at six experimental farms from Messina to Citrusdal, and co-operative trials on private farms and citrus estates are in progress at 12 localities.

Loosetkin citrus varieties

Considerable progress has been made with experiments to improve the fruitset of Clementine, a naartje variety which is very popular overseas. Both girdling of the tree trunks and spraying with gibberellic acid increased production considerably. Recommendations in this connection are being drawn up at present and will shortly be distributed to citrus producers. Although large-scale plantings of Clementine are not recommended as yet, researchers are optimistic that the cultivation of Clementine will prove to be an economic proposition. However, it is necessary to make sure that fruit of a suitable size can be produced. The importation of certain Corsican and Spanish selections can make an important contribution in this connection. The Corsican selections have already been established in orchards.

According to a preliminary climatic study certain coastal regions have climates that are better suited to growing Clementines than the traditional citrus areas of South Africa. Horticultural evaluations in the coastal regions concerned are being carried out at present.

Meristem grafting

The meristem grafting programme to purify existing selected clones from virus and other diseases has made exceptionally good progress and by the spring of 1981 it was already possible to hand over buds from a number of cultivars to the foundation block for the multiplication of super plant material. This programme is going ahead as fast as possible and new disease-free cultivars will be made available to the multiplication organisation annually. The process of pre-immunising all virus-free grapefruit with less virulent races of the tristeza virus in order to protect the trees against later infection by virulent races of the virus has been started.

Replanting problem

The hypothesis that allelopathy is involved in the replanting problem in citrus is supported by the discovery of ether extractable phenolic toxins that occur in the deeper layers of the citrus soil and in partially decomposing citrus root residues.

Homovanillic acid was provisionally identified as the most important growth inhibitor that occurs in partly decomposing rough lemon roots.

Crop prediction for Citrusdal

A new formula has been worked out on the basis of which crop volume and fruit size for both navels and Valencias can now be predicted. Climatic data for the period November to January are used. The prediction can therefore be made early in February each year.

Fruit size of midseason varieties and Valencias

Correct fertilising can produce 10 to 20 % larger fruit. Research has shown that for optimum fruit size the N content of the leaves should be relatively low (2,1 to 2,3 % N) and the K content relatively high (0,9-1,6 % K). This should reduce excessive fruit set and result in a smaller number of larger fruit.

Micro-irrigation/weedkillers

Trials to investigate the application of weedkillers in established orchards by the micro-irrigation system were very successful. With minor modifications to the irrigation system and to the standard rucksack spraying equipment, an orchard of 120 trees can be treated with paraquat in about nine minutes. If there are windbreaks, hand hoeing in orchards can be kept to a minimum. Problem weeds are later controlled by means of glyphosate spot treatment.

Entomology

Integrated control of citrus pests

Integrated spraying programmes for the control of citrus pests in all areas of the Republic, including the Lowveld, which has a difficult pest complex, have yielded very satisfactory results.

The programmes were revised and are being published. There are about two million citrus trees in South Africa which are not sprayed for red scale, which is under complete biological control. Integrated control has now been generally accepted by citrus growers as a means of reducing the cost of pest control by 50 % or more and this method is being extended very rapidly.

Observations have shown that an indigenous parasite of red scale, *Aspidiotiphagus lounsburyi*, is providing valuable control of red scale in the warmer Lowveld areas. It represented one third of all parasites present.

An integrated pest control programme with red scale under biological control has been drawn up for the Eastern Cape citrus areas. This approach to pest control works very well, especially in the Sundays River Valley, and producers are showing great interest in switching from a preventive programme to the proposed programme, which the Sundays River Research Station has been testing since 1978. At present annual spraying is carried out at the Research Station against bud mite only but it is expected that some producers will have to

include one or at most two sprayings for thrips in this programme.

False codling moth

It appears that the switch from a chemical to an integrated control programme has led to an increase in false codling moth in navels. A programme that included triazophos produced moderate suppression of false codling moth populations, but tartar emetic had no effect.

Control of citrus nematode

The citrus nematode *Tylenchus semipenetrans* can be successfully controlled by chemical means and the treatment of young, non-bearing trees in particular has become standard practice in overcoming the replanting problem.

Seven citrus nematode populations from South-West Africa and the most important South African citrus growing areas are being evaluated at present to determine the exact biotype of the populations. This research is a necessary preliminary and will serve as a basis for all future work on the citrus nematode. Overseas research has shown that there are four identifiable biotypes in the whole world and these biotypes differ from each other in respect of host susceptibility and general biology.

Pathological aspects

Less virulent races of tristeza virus that appeared promising against stem-pitting on grapefruit were selected and tested. Of the 50 selections, three will undergo further testing for application in the citrus industry. Greening is increasing in the Central, Northern and Eastern Transvaal and large areas are now threatened to such an extent by the disease that citrus production in these areas is becoming unprofitable.

PINEAPPLES

The latest research results have proved that the use of systemic nematocides as a plant treatment is economically unacceptable for the control of nematodes on pineapples. Depending on soil temperatures, soil treatment with either EDB (about 15 °C) or D-D (about 15 °C) remains the only economically acceptable method of controlling nematodes at present.

In the Levubu area double row spacing of Queen pineapples produced higher yields than single rows; stumps outyielded suckers planted at higher populations. Ridging can apparently be used to advantage in this area.

A polyester emulsion applied to the soil was reported to have been used with success in sugar-cane but has not proved of any benefit in pineapples.

Plant growth

A plastic mulch has definitely resulted in an improvement in initial plant growth. The improvement of soil temperatures could be the main factor.

At present a herbicide (Velpar) only has a role to play in soils having a high clay content ($\pm 30\%$). Yields, however, can be adversely affected when it is used as a booster on developing plants. The herbicide PP009 has shown much promise as a grass killer. It has the advantage that no phytotoxicity was observed even when the herbicide was used at excessive concentrations on developing plants.

Plant improvement

Selection work continued and 110 new clones of Smooth Cayenne were planted out.

Keeping quality

A number of waxes and fungicides have been evaluated for their effect on the keeping quality of pineapple fruit. Results have proved very promising in respect of fruit sold on the local market. Further tests are being conducted.

Preliminary results have shown that Fruitone CPA and Fruitone T are the most effective when the recommended concentrations are applied at 100 % dead petal stage and sprayed directly onto the fruit.

Soil insect pests

In studies on the effect of different cultural practices on beetle populations in soil, it has been found that green manuring has not resulted in an increase in the total population, although black maize beetle numbers were greater in plots so treated.

Excellent results in trials from isazophos at 10 kg ai/ha have led to the recommendation that the product be registered as a replacement for HHDN and dieldrin as a soil insecticide.

BANANAS

Plant pathological aspects

Three new cultivars, namely Valery, Gran Nain and Poyo, were imported from Central America through the agency of the Banana Board. These three cultivars are resistant to Panama disease in Central America and were imported since the disease has now become important in local Cavendish and Williams plantations.

Released from quarantine in January 1981, planting material has been established on infected farms for local immunity trials, and at Burgershall for phenology tests, production evaluation and bulking up. The material will be released to the industry through the Banana Board, if the cultivars prove satisfactory in the immunity and horticultural evaluation trials.

Plant improvement

From more than 100 original Dwarf Cavendish selections planted at Burgershall and Levubu, only two showed reasonable promise. These were selection 8 and selection 12, both being taller than Dwarf Cavendish, with bigger bunches and resistance to choke throat. These two local selections were planted at Burgershall in a critical comparison with Williams.

Phenology

A new trial, repeated at the Burgershall, Levubu and Natal sites, has been designed to compare the detailed responses of the two cultivars, under identical management, soil and climatic conditions, and also at two different spacings. At Burgershall and Levubu identical trials were established to investigate factors influencing Williams crop cycling time.

Spacing

A spacing trial is being conducted with Williams at Burgershall, with a smaller version on the Natal South Coast. Eight different spacing treatments are being compared, ranging from 1 000 to 2 222 mats/ha. At a similar population of 1 666 mats/ha, 3 different spatial arrangements are also being compared, namely rectangular, hedgerow and tramline. The main objective is to establish the treatment giving the highest yield of marketable fruit per hectare per annum, i.e. the best compromise between yield per crop and cycle time.

Crop timing

At Burgershall and Levubu, identical trials were established from September 1980 to March 1981, to investigate factors influencing Williams cropping cycles. The objective is to be able to plan ahead for a production peak at any specified time of the year. Treatments include 3 planting dates (Sept., Dec., March); 2 times of first sucker selection (5 months and 10 months after planting) and 2 plant spacings (3 x 2 m and 4 x 2 m). As an auxiliary study, bits and suckers of different sizes are being compared to assess the influence of planting material on time to first cropping.

Tissue culture

Progress has been made in the attempt to raise complete banana plants from small meristem pieces approximately 5 mm³ in size. To achieve this on a large scale will assist in the rapid bulking of a new cultivar, and in the elimination of viruses. So far the medium has been refined to suit the pieces of tissue and complete plants have been established by this method.

Banana snout beetle

There are indications that applications of pirimiphos - ethyl and aldicarb significantly reduce populations of the banana snout beetle

Cosmopolites sordidus Germar.

Pathological aspects

The imported Panana-resistant material was protected from the nematode *Radophylis similis* and is now being tested for resistance. The material is being multiplied at the Burgershall Research Station.

AVOCADOS

New cultivars were imported during the past year. The rootstock cultivars G6 and G755 (both patented) were imported from California for research purposes and Maoz and G.A.13 from Israel for local evaluation. The patented cultivars Pinkerton and Santana will be released soon for distribution to nurseries.

A new project has been registered to investigate the role of water relations in avocado physiology. Rootstock-scion combinations and environmental factors will be evaluated as well as the possible effects of water deficits on flowering, fruit set, fruit drop and fruit quality.

Fungitoxic substances have been extracted from avocado roots. The two most promising substances have been sent overseas for identification.

MANGOES AND GUAVAS

Selection work in respect of mangoes and guavas was continued and about six promising trees of each crop were selected. The selected trees will undergo intensive testing for yield and resistance to disease. In an espacement trial with coffee five different planting distances, from 1 800 to 7 200 plants per ha, were tested. Five different cultivars were compared in this trial.

Entomology

Six mite species and a species of thrips were collected from the young leaves of tea plants. Snout beetles which occur in the mango fruit of late cultivars are more resistant to gamma irradiation than those that occur in early cultivars. Two sprayings of prothiophos provided good control of mango scale. Sixteen plant-parasitic nematode species were identified from mango roots and the soil around the roots. Of these, spiral nematodes were the most numerous, but no significant nematode pests occur in mangoes. It has been found that two sprayings with fenthion provide excellent control of Natal fruitfly and marula fruitfly in mango fruit.

Surveys carried out in various pecan cultivars showed that Barton was least attacked by the pecan aphid. Spraying of macadamia trees with cypermethrin provided excellent control against attacks by the codling moth, the litchi moth and the carob moth. The parasitic nematodes can now be controlled in established papaya trees by means of the newly registered preparation feramiphos.

Leaf analyses reach a transitional stage

An important stage in the history of the CSFRI has been concluded with the discontinuation of the leaf and soil analysis service to producers of avocados, bananas, pecan nuts and coffee. What has taken place is the realisation of an ideal after many years of intensive research, rather than the discontinuation of a service. Now that this task has been completed, the practical application of the results can be handed over to private initiative so that the Institute can give more attention to the fertilising requirements of other subtropical fruit.

Many of the pioneer producers, especially of avocados and bananas, will remember how little was known about the fertilising of these two kinds of fruit about 25 years ago. If one looks at the Departmental recommendations for that time and compares them with the fertilising practices applied on the basis of leaf and soil analyses today, the savings that have been effected are enormous. In addition, production has improved a great deal. At the present cost of fertilisers a calculated annual saving of R3 million for bananas and R1 million for avocados is not excessive.

FLOWERS AND ORNAMENTALS

PROTEAS

Protea exports dropped by 11%, from 1,78 million kg in 1979/80 to 1,58 million kg in 1980/81. The present slump may be ascribed mainly to the deteriorating quality of export cut flowers and to the big oversupply of pincushions during late spring. This was the fifth successive year the European market was flooded with pincushions during the short period from the middle of September to the end of October.

At the 1980 protea farmers' day held at the Tygerhoek Experimental Farm at Riviersonderend, priority was given to possible solutions to these two problems. The most important recommendation was that the industry should switch increasingly to the intensive production of summer-flowering proteas. Not only is the quality of the cultivated cut-flower superior, but producers can supply species with complementary flowering periods, so that there is a continuous supply of flowers throughout the summer.

The first results of a new series of cold storage trials with proteas were extremely promising. Cold storage and transport by sea of proteas may be combined to extend and spread out the supply period and to help solve the present problem of scarce and expensive air freight space. The early results indicate that a minimum storage period of up to six weeks will be required and that shipping companies will have to maintain a constant storage temperature in containers. *Botrytis*

rot of pincushion flowers during storage has been identified as an important problem.

Establishment trials with rooted protea cuttings have shown that proteas are more sensitive to root disturbance than other crops. For instance, proteas cannot be planted with bare roots. Cuttings showed the highest survival percentage when directly rooted in the containers in which they had hardened off and then later transplanted without disturbance of the roots. The most economical container is the clear polyethylene seedling tube, which also permits inspection of root formation.

Research on ethylene as a chemical pruning preparation for pincushions has been concluded. Primary flower buds are "pruned", which extends the flowering period. Similarly, young growing plants are pruned to improve flower yield and growth habit. A larger crop of cuttings is also produced.

During the autumn of 1981 four new pincushion cultivars and the improved Kouga variant of *Protea repens* were released. Two of the pincushions are late-flowering cut-flower cultivar. The two cultivars were released to the local garden and landscape industry for the first time. The Kouga variant of *Protea repens* is the first protea material to be released. It is not a new cultivar, but a "variant" selected for its deeper red colour and earlier flowering period.

ORNITHOGALUMS

Five new *Ornithogalum* cultivars were released during the past season, namely:

Roes - white flowers with a black centre

Roodie, Rojel, Rollow, Rothea - flowers vary from pale yellow to dark yellow

All these cultivars have long stems, a good keeping quality and yield well. The cultivars with yellow flowers have the further advantage that their flowers remain open at low light intensities and do not close like those of *O. thyrsoides*, which is at present used as a cut flower. Another new cultivar, Rozelda, is being multiplied at present and will be released at the end of 1981. The plant breeders' rights on all these new cultivars are held by the Department.

LACHENALIA

Five selections were chosen from the *Lachenalia* breeding programme for release to the industry. Plant breeders' rights were applied for. These cultivars will probably be released to the industry at the end of 1981.

FLOWERING POT PLANTS

Plectranthus spp.

Research has been continued on indigenous species of this genus of evergreen herbaceous perennials which show promise as useful pot plants for interior decorating. All the species tested were very easily rooted from cuttings and could be rooted directly in the pots.

P. behnii

This species bears numerous spikes of pink flowers and the veins on the undersides of the leaves are tinged with purple. The plants respond readily to dwarfing with growth regulants. Flowering is readily induced by applying an effective day length of 10 hours and thus year-round production is possible.

P. oertendahlii

This species is useful both as a foliage plant and as a flowering pot plant. The leaves have attractive silvery white veins and the flowers which are borne in numerous spikes are almost white. The potted plants prefer shade and must not be overwatered. Plants can readily be brought into flower throughout the year by applying short day length conditions of 10 hours.

P. barbatus

This species bearing attractive variegated leaves with a pastel green background is especially useful as a foliage plant. It is a very rapid grower and for pot use requires dwarfing with a growth regulant.

Dianthus caryophyllus (carnation)

An investigation of the possible use of semidwarf varieties of carnation as flowering pot plants has been started. Initial results appear promising and the plants respond to treatment with growth regulants.

Streptosolen jamesonii (marmelade bush)

Preliminary investigations have shown that cuttings of this plant root easily and that young potted plants respond well to ancymidol (A-Rest) and can thus be dwarfed to the required shape. Plants also respond to day length treatment and with an effective day length of 10 hours can be brought to full flower in 9 weeks.

Growth regulants

Chlorocholine chloride (Cycocel), which has been used for dwarfing many species of ornamental plants for use as pot plants is not readily obtainable in South Africa. However, tests have shown that 1,1-dimethyl-piperidinium chloride (Pix), which has recently been registered for use on cotton, has approximately the same spectrum of activity as Cycocel and appears effective for dwarfing numerous ornamental plants. Good results have already been obtained with several species such as Pentas, Abutilon and Plectranthus spp.

Tissue culture

Two further new *Ornithogalum* cultivars and five new *Zachinabia* cultivars, are being multiplied to about 2000 plants each by means of the tissue

culture method and will be released to the industry during 1981.

POST-HARVEST HANDLING OF CUT-FLOWERS

1. Carnations *Dianthus caryophyllus*

After roses carnations are the most popular cut flower on the market. Although carnations have a fair vase life, "drowsiness" often occurs in the flowers. This phenomenon is caused by ethylene, a gas released by all ripening fruit, vegetables and flowers. A pre-treatment preparation has been developed that can eliminate this problem. The producer places the flowers in the solution for 24 hours after harvesting and then markets the flowers.

2. Chrysanthemums *Chrysanthemum morifolium*

Chrysanthemums are a popular cut flower, mainly because of their good vase life of about 10 - 14 days. However, with spray chrysanthemums the buds that were open at harvesting often open further but the closed buds do not develop at all. By placing the flowers in a pre-treatment preparation for 24 hours, all the buds can be made to open.

VEGETABLES

TOMATOES

Promising breeding lines of fresh market tomatoes in which resistance to nematodes is combined with quality and yield were obtained. Crossings were made with Auburn as one breeding parent in order to combine resistance to tobacco mosaic and nematodes and tolerance of cold.

Four finally selected breeding lines were tested by the Division of Plant and Seed Control during the past year for newness, purity and stability before being released to the industry.

(a) Market tomatoes

L 71/299-3-4-1

This line is highly resistant to bacterial wilt. It was bred for summer production in the Lowveld and its fruit quality was compared with that of Manapal. The plants have an indeterminate growth habit and grow luxuriantly; the colour of the leaves is dark green. The fruit is slightly smaller than that of Manapal.

L 52/299-1-11-1-1

This line is highly resistant to bacterial wilt, *Verticillium* and races 1 and 2 of *Fusarium* wilt. The growth habit of the plants is very compact and more determinate than that of Karino and Heinz 1370; the fruit is very firm.

(b) Factory tomatoes

L 23/172-2-1-2

This line is resistant to nematodes and one race of *Fusarium* wilt. Its most important characteristic is exceptional firmness, a property that has never before been associated with resistance to nematodes. The growth habit lends itself to cultivation on banks one metre wide and the yield and fruit quality compare favourably with those of standard cultivars such as Rossol VFN, Castlong and VF-134-1.

L 315/304-8-4-2-1 P4023 x L2024)

This line is highly resistant to bacterial wilt and one race of *Fusarium* wilt. This breeding line is comparable to VF 134 with regard to yield and is as good as or better than the latter in respect of fruit quality.

Cultivation research

(a) Evaluation of overseas cultivars

The evaluation of promising new canning cultivars from overseas breeders is being continued. Cultivars that show promise under local conditions include Lafayette, which bears firmer fruit than Roma, and VF 145 B 7879 from Petoseed, for juice production, and P 149, which has a higher solids content.

Twelve overseas fresh market cultivars were evaluated at Roodeplaat and Nelspruit. Single plant or mass selections for further evaluation or as breeding material were made from the following cultivars: Auburn 76, Cambella, Castleby, Walter Willemaire, Kootenai and Sandpoint.

(b) Control of nematodes

There is a possibility that EDB may disappear from the market and replacements are being sought. It is hoped to find replacements that will cut out the 14-day waiting period after treatment. To overcome this problem two preparations were tested at Roodeplaat to determine their phytotoxicity on tomatoes. These two preparations are Vydate L and Telone II.

Vydate was applied as a drench and Telone as a fumigant immediately before planting, followed by two sprayings of Vydate on the young plants. None of the treatments had any adverse effect on the plants.

GREEN BEANS

Seed of Rolito - a cultivar which is tolerant of halo blight - was released during 1980 and is being multiplied by seed merchants at present; adequate supplies should be available during 1981.

The series of breeding lines that have reached the testing stage are still making a good showing in general. The 181/64/191 and the 274/64 series appeared especially promising at Roodeplaat. These lines have straight, fairly long pods of a good

quality and colour, are highly tolerant of halo blight and regularly produce very high yields with a single harvesting. Seed is being multiplied for final evaluation.

Espacement, and consequently plant population, is one of the most important factors that determine whether optimum use is being made of the soil, the height at which the pods are borne, the quantity of seed required and the yield.

Trial with 10 different plant populations showed that at the widest espacement of 53 000 plants/ha, the plants bore 44 pods on average but a total of only 9,2 t/ha was obtained with hand picking. At an espacement of 125 000 plants/ha, 15,7 t/ha was obtained and at 400 000 plants/ha 15,9 t/ha was obtained. All things considered, the espacement for green beans should not be wider than 200 000 plants/ha or narrower than 300 000 plants/ha. This would require 60 to 100 kg of seed/ha.

PUMPKINS

Inbreeding and selection of Boer pumpkins has progressed so far during the past year that one line has now been developed that is purer than the standard commercial cultivars. The undesirable green layer just under the skin of the pumpkin is thinner than that of the breeding line and it is more uniform in size and general appearance.

MUSKMELONS

Breeding and evaluation were continued at Elsenburg, Roodeplaat and Addo. At Elsenburg attention was also given to transport and storage problems. It was established that the maturity of the fruit largely determines whether or not storage will be successful. This creates an additional problem since the degree of maturity of Elche - the most important export cultivar - is very difficult to determine in practice. At Roodeplaat attempts to develop good open-pollinated cultivars for the hot summer rainfall areas were continued.

GREEN PEAS

The frozen and canned forms remain the most important marketing channels for green peas. The aims of the breeding programme are geared to the requirements of these industries and to obtaining resistance to the disease involving several species of *Ascochyta* fungi and causing serious problems in the Southern Cape.

During the year the new cultivar *Robert* was released by the Institute. This cultivar possesses good processing qualities and produces very high yields. Seed is being multiplied.

ONIONS

The breeding programme for improving Caledon Globe and Australian Brown was continued. Eight Caledon Globe breeding lines and one Australian Brown breeding line were evaluated, together with certified Caledon Globe and

Australian Brown lines in trials at Elsenburg, Caledon and Riviersonderend. At Elsenburg six lines produced higher yields than the certified Caledon Globe line.

The breeding six lines were generally more uniform (70-80 % in comparison with 40 %) and less subject to bolting than the certified line Caledon Globe.

GARLIC

The wide interest in this crop with a view to export has decreased among producers. Overseas markets prefer white cultivars with larger and fewer segments per clove to the local types. For this reason the Institute has imported several virus-free cultivars for evaluation here.

The relatively small number of established producers obtained unprecedentedly high prices on the local markets during the past year. Research was therefore continued to determine the feeding and water requirements of the crop. Research on the latter has been completed and crop factors for irrigation scheduling have been worked out.

The first experiments to determine the feeding requirements showed that the plant prefers soil with a high nutritional status and responds very well to nitrogen. The production of large tubers is significantly improved by the administration of nitrogen, within limits.

Only one chemical weedkiller has been registered for garlic and trials at Glen with a wide variety of preparations have shown that five produced excellent results in respect of safety for the plant and effective weed control.

SWEET POTATOES

Owing to the undersupply of sweet potatoes on South African markets during October and November and the very good prices that can be obtained, even up to two months before and three months after this period, the extension of the harvesting and marketing season was undertaken.

Several methods are being investigated. Investigation of the following two has been completed:

Firstly, vines are overwintered in a hothouse for early planting (September-October) instead of the normal December period. Secondly, the crop is lifted earlier than usual, at various stages, to take advantage of the fact that sweet potatoes do not have a sharply defined physiological period of maturity.

The results showed that

- vines can be very successfully overwintered and multiplied in a hothouse;
- cuttings planted early in October are market-ready by early February and can therefore be marketed three months earlier than usual;
- the yield of the best cultivars when harvested 106 days after planting is 15 to 20 t/ha and this increases to 35 to 40 tons per ha when harvested the normal 150 days after planting.

This is still two months earlier than usual. Impala and Ribbok performed best.

It should also be noted that the harvesting of sweet potatoes during February and March is often accompanied by heavy rains and wet soils, which hampers the harvesting process a great deal. In addition to the advantage of better prices, infestations of sweet potato weevil and other insects were significantly lighter with early harvesting.

PLANT IMPROVEMENT SCHEMES

(a) Roses

The Horticultural Research Institute again supplied improved rose plant material to the industry during 1980/81. Brooks (1948) was again the most popular rose rootstock and 86 000 shoots were issued to the industry. This was followed by Clarke (1957) with 28 800 shoots. A total of 146 300 rose rootstock shoots were issued. In addition 35 000 buds of rose cultivars were issued.

(b) Strawberries

A total of 4 600 virus-tested strawberry plants of four cultivars were supplied to approved nurserymen under the scheme.

(c) Sweet potatoes

A total of 278 000 virus-tested sweet potato vines were issued to the nurserymen who participated in the scheme. Brondal, with 110 000, and Steenbok with 62 000 vines, were the two most popular cultivars.

PLANT AND SEED CONTROL INSPECTION SERVICES CONTROL OVER THE SEED TRADE

Registration of cleaners, prepackers and sellers of seed

The registration of cleaners and sellers of seed under the Seeds Act, 1961, was replaced on 1 June 1980 under the Plant Improvement Act, 1976, of premises where the sale, cleaning and prepacking of seed takes place. The registered undertakings from which the sale, cleaning and prepacking of seed takes place are distributed as follows among the four provinces:

	Transvaal	Cape	Natal	OFS	Total
Cleaners	42	25	7	16	90
Prepackers	17	8	5	0	30
Sellers	348	248	79	174	849
Total	407	281	91	190	969

Control over the cleaning, prepacking and sale of seed

A total of 969 seed distribution points were visited and 1 566 inspections carried out in order to check whether the provisions of the Seeds Act, 1961, and the Plant Improvement Act, 1976, are being complied with. 1 733 samples were taken for testing for physical and genetic purity and germination. Cautions were issued in 615 cases where the provisions of the Seeds Act had been contravened; 261 cautions concerned seed that did not comply with the germination requirements. Legal proceedings were instituted in the case of 43 serious offences.

Sealing lucerne seed

682 900 kg of lucerne seed was approved and sealed.

Legislation

On 1 June 1980 the Plant Improvement Act of 1976 and the regulations made under it came into operation, repealing the Seeds Act of 1961 and the regulations under it, except for the sections, regulations and notices relating to the seed certification schemes or export seed schemes.

SEED CERTIFICATION

This function includes the administration and application of the following schemes, whose purpose is the production of seed of a high quality:

(a) *The Basic Seed Scheme*, under which basic seed for the production of certified seed in terms of the Seed Certification Scheme and the OECD Scheme is grown

(b) *The Seed Certification Scheme*, under which variety-pure and variety-true seed of known origin is grown.

(c) *The Export Seed Scheme*, under which exclusively basic seed from overseas seed firms is multiplied under official supervision in the Republic.

(d) *The OECD Herbage and Oilseeds and Vegetable Seed Schemes*, which are similar to the Seed Certification Scheme, but enjoy international recognition.

Quantities of seed certified

The following table shows the mass (kg) of seed certified under the various schemes:

Crop group	Basic Seed Scheme	Seed Certification Scheme	Export Seed Scheme	OECD Herbage and Oilseed and Vegetable Seed Schemes	Total
Vegetables	19 787	1 030 567	227 839	-	1 282 058
Field crops	1 049 780	14 513 619*	-	1 038 993	16 598 527
Pastures	14 612	102 528	-	-	117 140
Total 1980/81*	1 084 179	15 646 714	227 839	1 038 993	17 997 725

*Includes 163 510 and 9 622 300 kg of basic and certified maize seed respectively

International activities

Seed certification schemes of the Organisation for Economic Co-operation and Development (OECD)

South Africa continued its participation in the OECD Herbage and Oilseeds and Vegetable Seed Schemes. 1 024 tons of lupin seed and 1 458 tons of sunflower seed were certified in terms of the OECD Herbage and Oilseeds Scheme. A major portion of this seed was exported to the European Economic Community.

European Economic Community (EEC)

With regard to plant and seed matters, the Division is kept up to date by the Agricultural Counsellor (Economics) in Brussels on the introduction of or amendments to relevant guidelines. Close liaison is essential in order to comply with EEC requirements regarding the exporting of plants and seed to member countries of the community.

The EEC renewed the equivalence South Africa enjoys with regard to the certification of certain herbage and oil seeds and maize seed for a further period of three years, up to 1 July 1983.

SEED POTATO CERTIFICATION

Foundation seed potatoes

Field screening

Elite seed potatoes from the Department's Sabie unit are multiplied by the Potato Board at its foundation seed potato unit at Lydenburg. A total of 28,57 ha was planted, BP1 and Up-to-Date the most important varieties.

Tuber inspection

11 727 units of 30 kg each of foundation seed potatoes, consisting chiefly of BP 1 and Up-to-Date, were certified.

AA Certification

Field screening

AA standard potatoes are grown mainly in the Northern Cape, the South-Western Free State and to a lesser extent in the Transvaal, Natal and the Western Cape. 4 004 ha was submitted for certification. 116 ha was rejected, mainly as a result of too high a virus content, the chief viruses being leafroll and mosaic in Up-to-Date and Yn in BP 1.

Tuber inspections

The quantities certified amounted to 584 538 x 30 kg.

102 663 x 30 kg was rejected, chiefly for exceeding the tolerances for nematode and potato tuber moth infestation and *Rhizoctonia solani* infection.

A certification

Field screening

In the A area, which is situated chiefly in the Transvaal, the Eastern and Central Free State and the Western Cape, 4 476 ha was submitted for inspection. Only 425 ha was rejected, chiefly as a result of virus infection.

Tuber inspections

The quantity certified amounts to 970 264 x 30 kg. A total of 40 357 x 30 kg was rejected, mainly for exceeding the tolerances for nematodes, potato tuber moth and *Rhizoctonia solani*.

General

Varieties

The most important varieties (in order of importance) of which seed potatoes were certified were BP 1, Up-to-Date, Van der Plank and King George.

Performance tests

A total of 2 461 samples were planted for purposes of performance testing. The tests give an indication of the efficiency of the control of virus diseases by tuber producers and form the basis on which producers may participate in the scheme.

GRAPE VINES

Selected plant scheme

Basic blocks

Rootstocks

The number of rootstocks that complied in all respects with the requirements of the scheme was 38 090.

Scions

A total of 188 633 plants were approved and 121 000 grafted vines will be considered for certification.

SA super plant scheme

(a) Parent blocks

(i) Rootstocks

To date 308 906 rootstocks have been established at 29 registered nurseries.

(ii) Scions

Scion parent blocks have been laid out at five nurseries. The number of scions established so far is 39 475 and nine varieties are represented.

(b) Nursery blocks

A total of 165 200 cuttings for planting were established in seven nursery blocks and 56 500 rooted vines were certified.

POMES AND DRUPES

Selected plant scheme

(a) Rootstocks

Nurserymen supply their own requirements but also use rootstock material from the Super Plant Scheme if it is available.

(b) Scions

Over 1 992 760 (443 080) scion buds were supplied to qualified nurserymen by SAPO.

(c) Nursery blocks

A total of 43 557 nursery plants of various types were certified.

Super plant scheme

This scheme is now starting to grow according to expectations and certified super plants should be fairly freely available within a foreseeable period.

(a) Parent blocks

Rootstocks

To date 68 335 certified rootstocks, of which BP 1, BP 3 and M 793 are the most important, have been established in 37 parent blocks from material supplied by SAPO.

(b) Nursery blocks

(i) Rootstocks

A total of 23 nurserymen laid out nursery blocks during 1980.

(ii) Scions

1 633 546 buds and 48 200 grafts, mainly of plums, apples, pears and apricots, were issued to nurseries by SAPO.

(iii) Super plant trees

A total of 157 906 trees, consisting mainly of plums, pears, apples and apricots, were certified.

Strawberry scheme

2 516 877 plants were certified.

Cherry scheme

5 710 cherry trees and 1 500 buds were

certified.

Rose improvement scheme

The first foundation block of rootstocks came into production. Over 10 000 rose foundation plants consisting of 28 varieties were approved.

INSPECTION OF FLOWERING BULBS INTENDED FOR EXPORT

In all 13 winter bulb varieties, covering an area of 85 ha, and 12 summer bulb varieties, covering 19 ha, were submitted for inspection.

NURSERIES

Registration

The registered nurseries are distributed as follows over the four provinces:

Transvaal	1 299
Cape	966
Natal	428
OFS	100
Total	2 793

Inspections

3 946 visits were paid to nurseries for purposes of inspection and 1 117 plant samples, 14 soil samples and four water samples were submitted for examination for plant diseases and insects declared under the Agricultural Pests Act.

Quarantine was imposed at 128 nurseries owing to the incidence of harmful insects and plant diseases. The total number of plants affected by quarantine was 2 668 873. Infestation with rootknot nematode and stubby root nematode (1 283 031), *Phytophthora* (1 133 893) and crown-gall (220 753 plants) was the most important reason for quarantine. 450 686 infested plants were voluntarily destroyed by nurseries.

Prosecutions and cautions

Seventy-four owners of nurseries were prosecuted for failure to renew their registration. 1 948 written cautions were sent to owners of nurseries, in order to bring the requirements of the new Plant Improvement Act to their attention.

Legislation

On 1 June 1980 the Plant Improvement Act of 1976 and the regulations made under it came into operation, thereby repealing the sections of, and regulations under, the Agricultural Pests Act of 1973 that relate to the registration of nurseries. From 1 June 1980 nurseries are registered in terms of the provisions of the Plant Improvement Act of 1976. For the first time the Plant Improvement Act has laid down requirements in respect of physical quality for plants, the marking or labelling of plants, the keeping of records of plants sold and

requirements for nurseries.

CONTROL IN RESPECT OF IMPORTED AND EXPORTED PLANTS AND PLANT PRODUCTS (INCLUDING SEED)

As a contracting party to the International Plant Protection Convention, the RSA has an obligation to help prevent the international spread of harmful plant pests (insects and diseases).

This includes the application of strict phytosanitary requirements in regard to plants and plant products that are imported and the inspection of similar material that is exported in order to determine whether it complies with the requirements of the importing countries. In addition to phytosanitary requirements, quality requirements are also applicable to seed imported into South Africa.

Imported plants and plant products

With a view to phytosanitary control, 4 240 plant import permits in which the phytosanitary requirements are stated were issued. About 290 000 tons of plant products, 7 000 tons of which consisted of plant seed, were checked for phytosanitary purposes and 17 516 inspections were carried out in the process. In 609 cases the imported products were retained by the inspectors on account of irregularities, inadequate documentation or infestation with pernicious plant pests.

4,6% of the seed did not comply with the quality requirements for imports. A consignment of pea seed with inadequate germination contributed 2,1 per cent to this figure.

Exported plants and plant products

The quantity of commodities checked for phytosanitary purposes amounted to 2 629 million tons. In addition about 47 million flower bulbs, tubers and rhizomes, 1,4 million plants and cuttings, 0,3 million cubic metres of timber and 1 500 tons of cut flowers were inspected for the same purpose. The number of phytosanitary certificates issued amounted to 19 366.

QUALITY CONTROL

GERM PLASM AND PLANT INTRODUCTION

Germ plasm bank

Particulars of 8 170 seed samples stored in the germ plasm bank have already been recorded in the Index Seminum. There was an addition of 328 new specimens to the germ plasm bank. The ninth volume of the Index Seminum was published and distributed to interested persons and bodies in South Africa.

Plant introductions

The number of samples of seed and vegetative material supplied to local and overseas researchers amounted to 26 707. 32 814 samples were obtained, chiefly from overseas.

PURITY TESTS

The number of varieties of declared kinds of plants included in the varietal list amounted to 75. The most important kinds were: maize, sorghum, soya-beans, cabbage and tomatoes. Over 4 869 control tests for variety purity of seed samples of imported and certified seed, as well as of seed drawn from the South African seed trade, were carried out. The kinds of which the largest number of samples were tested were potatoes, maize, soya-beans, cotton, grasses, grain sorghum, sunflowers, tomatoes, garden beans, cabbage, gem squashes, onions, carrots and peas.

PLANT BREEDERS' RIGHTS

The amended legislation on plant breeders' rights came into operation on 2 January 1981. The amendments were necessary in view of changes introduced into the International Convention for the Protection of New Plant Varieties, of which South Africa is a member country.

Spain became a member of the International Union for the Protection of New Plant Varieties (UPOV) in 1980. The UPOV Technical Working Group for Fruit Crops met in May 1980 in South Africa to draw up international guidelines for citrus, Japanese plum, Kiwi fruit and persimmons. The Director of Plant and Seed Control and Mr J Rietmann of the Paris Office represented South Africa at the UPOV board meeting which was held in Geneva during the week of 13 October 1980.

Applications for the grant of plant breeders' rights were received in regard to 35 varieties, mainly of roses and soya-beans. Plant breeders' rights were granted for 37 varieties. The total number of varieties covered by plant breeders' rights amounts to 97, 57 of which are locally bred varieties. During the year under review four *Leucospermum* and two *Protea* varieties were registered in the International *Protea* Register, which is kept by this Division at the request of the International Horticultural Society.

BREEDERS' PLANT MATERIAL

The purification and maintenance of certain varieties, some of which were developed by the Department and some of which were "open", to obtain propagating material of high genetic quality for use in the production of certified material was continued in co-operation with officers from several regions and institutes.

The Committee for the Maintenance of Vegetable Varieties, which consists of

representatives of the Department and the private seed trade, has already allocated about 60 varieties of different types of vegetables to official and private plant breeders for genetic purification and maintenance. Improved material that becomes available in this way is intended for the production of certified seed.

ANALYSIS, TESTING AND EXAMINATION OF SEED

The number of samples submitted has remained virtually static at 8 765 but the number of tests carried out has increased to 28 301. Maize remained the most important of the field crops, followed by sunflowers, soya-beans, cotton and lupins.

Onions and garden beans were the most important vegetable crops, followed by tomatoes, peas and carrots.

The mass of seed exported under cover of international seed analysis certificates amounted to 1 272 682 kg. Assistance in connection with germination, identification and various projects was given to private persons and to various bodies including the Department of Water Affairs, Forestry and Environmental Conservation, the University of Pretoria, the Plant Protection Research Institute, the Defence Force, the South African Police, the Maize Board, the Wheat Board, the Pretoria Technikon and the Department of Agriculture and Forestry of Venda.

The seed collection, which is used mainly for purposes of verification, is now undoubtedly the biggest in the country and contains about 14 000 specimens, subspecies and botanical varieties of between 2 000 and 3 000 genera. The accession is a fairly extensive collection of seed of Biblical plants. Mr J.F. van Wyk, Director of the Division, represented South Africa at the 19th Congress of the International Seed Testing Association, which took place in Vienna, Austria, in June 1980.

ASSISTANCE TO INDEPENDENT STATES

In terms of an agreement entered into between the RSA and Transkei, Bophuthatswana and Venda when they became independent, the Division of Plant and Seed Control provides assistance and services in connection with phytosanitary matters and matters concerning plant and seed quality. One of the senior inspectors of the Division was seconded to the Transkei Government to train officers locally and set up technical facilities. Officers from Venda paid a visit to the RSA for purposes of training and this was followed by a visit to Venda by several officers of the Division.

11. Animal production improvement

LIVESTOCK PRODUCTION RESEARCH

BEEF CATTLE

The long-term crossbreeding and purebreeding project which is being carried out at Mara with various breeds and types of beef cattle again produced important and interesting information. The year under review was characterised by the attainment of the highest average weaning masses at 6½ months that had ever occurred in the pure-bred and the cross-bred groups at Mara. This was due chiefly to the good condition of the veld (sweet bushveld) as a result of both the favourable weather conditions, and the sustained application of controlled selective grazing. It appears that it was largely the good condition of the veld that enabled the inherent potential of the breeds and crosses to be realised.

The following average weaning masses, relative weaning masses (i.e. weaning masses expressed as a percentage of the cow mass at the first weighing after calving) and weaning mass production of cows per ha (at a stocking rate of 9,7 ha per large stock unit) were obtained:

Breed or crossing	Average weaning mass (kg)	Weaning mass as % of cow mass after calving	Weaning mass production per ha (kg)
Africander	199,7	44,5	13,97
Hereford	214,9	46,0	17,18
Bonsmara	228,8	42,4	22,15
Simmentaler	261,9	52,5	25,32
Hfd/Afr criss-crossing	221,5	47,1	18,44
Simm/Afr criss-crossing	240,0	48,6	20,63
Simm/Afr three way crossing	238,8	47,8	22,39

The outstanding performance of the Simmentaler in all three respects is striking.

The considerable increase in the average weaning masses that has occurred since 1970/71 reflects an increase in birth masses at the same time. Except in the Bonsmara, where the increase in birth masses was notably higher than in the other breeds and crosses, these increases were not a cause for concern, however. Nevertheless, it will be necessary to guard against excessive increases in birth masses, which would be likely to contribute to calving problems.

The healthy reproductive status of all the breeding groups is indicated by the percentage of calves that arrived during the first 30 days after the birth of the first calf in each breed or crossing. During the year under review this varied from

66,7 % for the Africander, Bonsmara and Simmentaler to 88,2 % and 89,5 % for the Hereford and Hereford/Africander cross-crossings respectively, with the remaining two crossings falling in between. All three of the cross-bred groups performed better in this respect than their respective pure parent breeds.

The beneficial effect of crossbreeding on fertility was again apparent, as in previous years, and is reflected in the following statistics:

Where the calving percentage of the Africander was 84,6 % that of the Hereford 85,0 % that of the Bonsmara 75,0 % and that of the Simmentaler 92,3 %, in the three cross-bred groups the percentage was as high as 95,0 % (Hfd/Afr), 94,9 % (Simm/Afr) and 92,5 % (Simm/Afr/Hfd). A similar advantage in favour of the cross-bred groups was also apparent in the lower peri-natal mortality of calves in those groups. In the Hfd/Afr and Simm/Afr groups the mortality rate was nil and in the Simm/Afr/Hfd it was 2,6 %, whereas in the pure breeds the mortality figure was 3,0 % for Africanders, 5,7 % for Herefords, 6,3 % for Bonsmaras and 2,7 % for Simmentalers.

A low reproduction rate and irregular breeding in cows and heifers is a problem in the Eastern Cape and the hormone pictures of the animals were therefore studied. The protein binding technique for determining oestrogen and progesterone is being investigated at Dohne.

The hypothesis that other factors are involved in the extent and rate of reproduction in beef cattle was confirmed at a recently concluded study on the level of nutrition in beef heifers during the first winter after weaning. Although body mass increase after the first winter was 25 % higher in the groups that were fed and had a growth rate of 0,55 kg per day during the winter than in the maintenance groups with a zero growth rate, this advantage disappeared after the first calving and there was no beneficial effect up to the fifth and sixth year of reproduction in body mass, birth masses, weaning mass or calving percentage.

It was found at Dohne that 70 % to 80 % of the heifers at 15 to 18 months could be made to reach the mating mass of 300 kg by feeding them during the first winter to ensure a body mass increase of 0,55 kg per day. If the improved feeding was discontinued during the following summer and winter, the advantage disappeared after the first calving.

Additional feeding is not necessary in the grass-bush communities of Adelaide, since calving percentages of 95 to 103 % and weaning masses of 260 kg at seven months of age can be obtained. Research is being directed towards identifying the stress factors in the sourveld areas.

In Natal Drakensberger and Simmentaler x Hereford cows were primed with progesterone releasing agent during normal and restricted (once daily for 15 days) suckling. Restricted suckling increased the number of cows that ovulated by 40 % and 100 % in the Drakensbergers treated at day 45 and day 70 post partum, respectively, but no such effect was observed in the Simmentaler x Hereford cows.

The performances of dual purpose and British cross cows and calves were compared on kikuyu pasture over the summer grazing season. Stocking rates (SR) of 4.6 (Low) and 7 (High) cows plus calves, per ha, were applied with each of the cattle types. In a season in which total summer rainfall was 35 % below average, weaning masses of 173 and 193 kg for the High and Low SR dual purpose calves and 168 and 192 kg for the High and Low SR British cross calves, respectively, were recorded. Calf livemass gains per ha of 836 and 635 kg were obtained over a seven-month period in the High and Low SR groups, respectively. Stocking rate did not influence reconception rates in the cows.

No benefit was derived from supplementary feeding of urea to weaner heifers fed good quality *E. curvula* hay plus mineral lick. Supplementation of direct cut *E. curvula* silage with urea resulted in decreased intake of silage dry matter and poorer performance of weaner heifers. Feeding hay with grass silage improved mass gains of heifers.

At **Potchefstroom** the replacement of maize grain with sorghum grain (sweet sorghum and bird-resistant sorghum) in the finishing rations of 18-month-old steers was investigated. The digestibility of the sorghum grain was lower than that of the maize grain, especially the protein digestibility of bird-resistant sorghum grain. However, the higher intake of the sorghum grain by the oxen in comparison with the intake of maize meal meant that oxen that received sweet sorghum grain in their rations grew just as well as oxen that received maize meal. Poorer growth percentages obtained with the use of sorghum grain in the rations may be ascribed to a low digestible protein content. The problem could probably be partly solved by providing extra digestible protein in the ration.

The investigation into the effect of phosphorus supplementation to beef cows and their progeny is being continued at the Armoedsvlakte Research Station and at Glen. Both these studies are intended to cover the entire reproductive life of the cows.

In the investigation at **Armoedsvlakte** the serious phosphorus deficiency the cows experience was strikingly reflected by the bone and blood concentrations and the changes in body mass and reproductive ability of the cows. During February 1981 the cows that were given no phosphorus supplementation were 140 kg lighter on average than the cows that received phosphorus supplementation. This major difference between the two groups in respect of body mass is dramatically reflected in their breeding capacity. The cows that

received a phosphorus supplement showed a calving percentage of 100 %. Those that received no phosphorus supplement had a calving percentage of 55 %. Moreover, the birth masses of calves whose mothers received phosphorus supplementation were 5,2 kg higher on average than where no phosphorus supplementation was given.

The investigation carried out at **Glen** shows that there are locality differences in the response of cattle on veld grazing to phosphorus supplementation. Lactating cows that received no phosphorus supplement are not affected to nearly the same extent as at **Armoedsvlakte**. However, it is apparent that phosphorus supplementation at Glen does have a beneficial effect on the weaning masses of the calves. During the past two seasons phosphorus supplementation resulted in 10 and 15 % higher weaning masses respectively.

During the 1980/81 season fertilised (100 kg of nitrogen + 10 kg of phosphorus per ha per year) and unfertilised veld at **Potchefstroom** was utilised from the middle of November to the end of May by Simmentaler steers and Merino wet ewes, using the system of controlled selective grazing.

When they began grazing the steers were about one year old and the lambs two weeks old. The stocking rate on the fertilised veld was 100 % higher than on the unfertilised veld. Despite the higher stocking rate the growth rate of the steers on fertilised veld was 20 % higher than on unfertilised veld (0,79 kg per day as against 0,66 kg per day). The average masses of the steers at the end of the grazing period at an age of about 18 months were 399,5 kg and 374,5 kg on the fertilised and unfertilised veld respectively. The lambs on the fertilised veld grew at a rate of 99 g/day and those on the unfertilised veld at a rate of 85 g/day (16 % faster growth on the fertilised veld). The mass increases per ha (steers plus lambs) were 137 % higher on the fertilised than on the unfertilised veld (142 kg/ha as against 60 kg/ha).

At the current fertiliser and meat prices the production of weaner lambs and steers from fertilised veld may be more profitable than production from unfertilised veld. The further beneficial effects of fertilising veld on wool production per ha were not taken into account for the purposes of this calculation.

Preliminary results at **Bethlehem** indicate that, at the current meat prices, weaner calves can be successfully and economically finished on small grain pastures, although the fat cover is not entirely satisfactory.

DAIRY CATTLE

In the **Natal Region** where cows graze kikuyu a marked drop in milk production is observed during autumn. Research results obtained at Cedara indicated that this drop in milk production is principally caused by the low intake of herbage by the cows and not by a drop in the nutritive value of the kikuyu herbage. Supplementary feeding of 15 kg of maize silage or

3 kg of a feed mixture, made up of *E. curvula* hay, maize meal and high protein concentrate in addition to the normal concentrates fed to production, maintained the level of milk production in autumn. With both supplements the average daily production per cow for the period mid-February to mid-May was 1.5l higher than that of cows receiving no extra supplement.

The milk production of the cows in the Cedara herd has increased noticeably when the feeding method set out in Feeding and Management of Dairy Cattle in Natal, by Bredon and Steward (1979) was applied, as the following table will illustrate.

Average milk production of cows in the Cedara herd (kg)

Period	1st lactation		2nd lactation		3rd and following lactations	
	Over 300 days	Production at peak	Over 300 days	Production at peak	Over 300 days	Production at peak
1965-73	3 217	13,0	3 728	17,0	4 228	19,3
1978-80	4 381	17,7	4 831	21,5	5 167	22,7

The feeding system embraces steaming up, challenge feeding for the first 12 days of lactation, together with optimum use of pasture and other roughages.

Computerised programmes to aid the dairy farmer have been developed in the Natal Region. One programme deals with concentrate feeding of cows in milk (FEEDIN) and the other deals with management of the whole herd (DAISY). Over a period of ten years, from 1970 to 1980, milk production per lactation of all herds in the National Milk Recording Scheme in Natal increased by 601 kg. Over the same period the average production per lactation where producers used both FEEDIN and DAISY regularly increased by 925 kg compared to 220 kg where the programme were not used at all or where one of them was used irregularly.

The part artificial pastures, including small grain pastures, can play in the breeding programme of dairy cows is very important and is still being investigated. Data from trials at the research station at Bethlehem indicate that it would be economically efficient to include rye and oats, grown on dry land, in a feeding programme for dairy cows.

At Glen success was also achieved with cut green oats or sorghum hybrid as the only roughage for milk production.

It was established at the Outeniqua Experimental Farm that Jersey cows run on pastures with only limited concentrate supplementation were able to maintain satisfactory production. The average production of the group put to pasture twice a day was about 4 000 kg per lactation, with a butterfat percentage of 4,78 %. This was about 10 % higher than that of the group put to pasture overnight and given silage by day. The cattle given silage only produced about 2 600 kg. It may be concluded from this that silage

cannot replace pastures in the production system, although it can play a supplementary part.

In a demonstration trial for calf rearing systems the group weaned early (as recommended by Elsberg) did better than groups reared according to two systems applied by farmers in the Southern Cape. It was found in another trial at Elsberg that calves weaned gradually did not do better than similar calves weaned suddenly. There is therefore no justification for the extra demands made on management by gradual weaning.

A remarkable breakthrough was achieved at Dohne with the use of whey powder for early weaning systems for calves. This waste product (whey) of the cheese industry has so far had a limited application and is seldom included in any rations in quantities larger than 15 to 20 %. In trials with calves whey was included with homogenised beef fat during the spray during process to manufacture a relatively cheap high-fat whey powder. Satisfactory growth rates of up to 393 g/day were obtained when the powders were used to constitute up to 70 % of home mixtures and in combination with skim-milk powder.

Optimum biological and economic growth was obtained with milk replacer mixtures with a crude protein content of 22 %. When high-fat whey powder constituted over 60 % of the inclusion levels the digestibility of the milk replacers, the nitrogen and the starter meal decreased, however. The inclusion of low levels (20 %) of high-fat whey powder caused diarrhoea. However, diarrhoea decreased with higher inclusion levels, with a turning point at 60 to 80 %. After this diarrhoea increased drastically. With controlled high-fat whey milk replacers and starter meal feeding calves can be weaned economically at the age of 30 days at present (1981) costs of R16 to R20 per calf.

Dairy herds

In 1979/80, during 100 lactations the Frisian herd of the Animal and Dairy Science Research Institute maintained an average production of 6 466 kg of milk with 3,19 % butterfat, and 3,33 % protein and a calving interval of 402 days. This places the herd first in the Transvaal and second in the RSA for grad Frisian herds containing more than 19 cows, milked twice a day. The herd holds the Junior 2, Junior 4 and Adult records, with productions of 8 413 kg and 12 381 kg of milk, respectively.

MUTTON SHEEP

The potential for meat production of the South African Mutton Merino and the Dorper is being investigated at Glen by making extensive use of crop residues as a low quality roughage. The favourable effect of feeding on reproduction is clearly reflected in the results. It is also apparent that the weaning percentage and feed costs of the ewes are the two most important factors that make this type of enterprise economically acceptable.

The effect of phosphorus supplementation on Dorper ewes is being investigated at **Armoedsvlakte**. This investigation is necessary in view of the dubious benefits, of phosphorus supplementation to Merino ewes at Glen and Dorper ewes at Koopmansfontein. Since a definite phosphorus deficiency has been identified at Armoedsvlakte the study of sheep at Armoedsvlakte can help answer the question whether phosphorus supplementation for sheep, is really beneficial.

Although the blood phosphorus level in ewes drops to far below the generally accepted safe level during lactation, this has no notable effect on the growth of their lambs. These findings largely corroborate results obtained at Glen and Koopmansfontein in this connection.

In an evaluation programme with artificial pastures for mutton production at **Elsenburg** it was found that medic pastures can produce 100 kg of meat plus 20 kg of wool per ha. Similar figures were achieved at the Outeniqua Experimental Farm in a slaughter lamb trial in which no supplementation was provided.

The treatment of low-grade roughages such as wheat straw is still being investigated and promising results have been obtained with urea ensilage. Experimental samples compared well with oat hay in terms of digestibility, voluntary intake and mass increases. The further development of these methods so that they can be applied on a commercial scale is being investigated.

Various by products from other industries are potential sources of feed. Digestibility studies on wine yeast and grape skins were carried out during the year under review. The digestibility of the former was so low that it had virtually no value as a stock feed, but grape skins can be used to advantage in drought rations and can constitute up to 30 % of such rations.

A study was undertaken at **Irene** to compare the efficiency of growth and meat production in short scrotum lambs (two techniques of castration), ram lambs and wethers. The animals were slaughtered at three masses, namely 20, 40, and 60 kg. No significant differences were found in the treatment groups were found in the treatment groups in respect of age at slaughtering and average daily increase. One type of short scrotum lamb had a better feed conversion ratio than the other three groups. No differences could be found in slaughter characteristics (dressing percentage, grading.)

At Grootfontein it was decided to apply autumn mating instead of spring mating with the Afrino. This decision produced very good results, as is apparent from the fact that the weaning percentage (lambs weaned expressed as a percentage of ewes available for mating) of 139 % was considerably higher than the 80 % average obtained with spring mating from 1976 to 1979.

The corrected 100 day mass of 25,6 kg for rams and 25,5 kg for ewes was considerably less, however, than the 32,9 kg and 29,83 kg obtained on average for rams and ewes from 1976 to 1979 with

spring mating. On the other hand the 12 month mass was considerably higher than the 1976 to 1979 average, namely 57,0 kg as against 46,9 kg for rams and 44,1 kg as against 40,7 kg for ewes.

Under intensive farming conditions at **Cedara** mating at intervals of twelve months and eight months was investigated, using S.A. Mutton Merino sheep. Over a period of two years the feed costs for mating ewes at eight months were ten per cent higher than for mating at 12 months. The feed costs for lambs were 30 % higher for the eight months than for the 12 months' mating period. The average income per ewe for those animals on the eight months' mating system was 30 per cent higher than that for the 12 month mating system.

BOER GOATS

At the **Adelaide Experimental Plot** it was found that excellent and economic production can be maintained with Boer goats. Fecundity figures of 2,12 and 2,15 were obtained during the 1978/79 and 1979/80 seasons. With only slight nutritional support for ewes suckling more than one lamb during the first 14 days after lambing, excellent growth rates of 150 to 180 g per day were maintained on the veld and young replacement ewes attained a mating mass of 55 kg at 15 to 18 months. Growth margins of R16 to R20 per Boer ewe were realised. The latter were about 30 % higher than those obtained per small stock unit with sheep.

However, the economics of the long-term inclusion of the Boer goat are affected by the high incidence of abortions in Boer goats. During the 1978/79 and 1979/80 seasons 25 to 40 % of Boer goat ewes aborted and this problem is consequently being given serious attention.

Oestus periods of Boer goat ewes fed intensively throughout on either high energy or low energy rations were monitored throughout the year. In no month was there complete anoestrus. The peaks of sexual activity appear to fall in May (February to June) and in August.

PIGS

Owing to the continuing shortage of protein-rich feeds suitable for inclusion in pig rations, research at the **Animal and Dairy Science/Research Institute** has been concentrated during the past year on protein saving and the optimum use of protein sources. A study to determine the optimum inclusion level of full-fat soya-bean meal in growth rations, with a medium energy level (13,2 MJDE/kg of air-dried meal) revealed that the inclusion of 15 % soya-bean meal at a lysine level of 0,70 % is sufficient for porker production.

The composition and nutritional value for the pig of dehydrated lucerne meal, cut at various growth stages, were investigated. The results show that the protein and lysine contents were considerably lower (17,2 and 31,3 % respectively) in four-week than in three-week cut samples. The

variation in protein content and quality of South African fishmeal and sunflower oilcake meal was also studied.

During the past year research in the **Winter Rainfall Region** was aimed chiefly at nutrition. Particular emphasis was placed on the evaluation of locally available sources of feed and/or the supplementation of such sources of feed for optimum utilisation in pig rations.

A trial on the effect of the physical form of creep rations on pre- and post-weaning intake and performance of piglets showed that creep pellets have decided advantages over creep meal.

As a result of the interest shown by the pig industry in a artificial insemination scheme, diluents (Tris/Fructose and Kiev) were compared at Irene with standard procedures for the preservation of semen at 15 °C and 5 °C.

The fertility of semen stored at 15 °C and of the imported liquid and frozen semen was monitored.

With the necessary skills and knowledge of A.I. fertility results of 80 to 85 % farrowing and an average farrow size of 9-10 piglets were obtained with a Kiev diluent. The fertility of frozen semen was considerably lower and it was possible to produce four times as many piglets with liquid semen as with frozen semen.

It appears from a study of the production records of six pig producers that weaning and oestus periods are extended in the summer months whereas the farrowing rate decreases. This effect can be ascribed to high temperatures, especially when they are combined with high humidity.

POULTRY

It was found in the course of a project to determine to what extent fishmeal in poultry rations can be replaced by sunflower oilcake meal that certain lines of commercial egg production hens produce better at a lower level of lysine than at a high level. Some lines were more sensitive to a low level of lysine than others, however.

The use of restricted feeding of laying hens to reduce feeding costs indicates that the restriction of feeding causes a decrease in total egg production, and that this is most marked when the hens are at top production levels. It was also found that there was no relationship between the restriction of food and the accumulation of body fat, although it appears that the restriction of food after top production has been reached does counteract the accumulation of body fat.

In order to improve the efficiency of hatchability, a system of feed restriction is applied to broiler dams. It has been found that a 10 % food restriction produces the best results. However, there were major differences between the various lines.

Differences of up to 25,9 % in the efficiency of feed conversion between cockerels of the various lines have been found. It appears that genetic variation is responsible for a major part of the differences.

Imported laying breeds are crossed in order to fix the characteristics of efficient lines. Two genetic controls flocks are still successfully maintained in order to determine the progress in egg production of local blood lines.

Waterfowl research

Good progress is being made with the breeding of an efficient slaughter duck. To date the body mass at 49 days of age has increased by an average of 2 % annually and the fertilisation and hatchability figures have also improved considerably.

Electrical stimulation

Following research on the electrical stimulation of warm beef carcasses, the technique is already being applied at two of the biggest commercial abattoirs. This eliminates the adverse effects of rapid chilling of newly slaughtered carcasses on the tenderness of the meat, which means that the consumer will be able to obtain red meat of far more consistent quality.

Carcase grading

After six years' intensive research at the **Animal and Dairy Science Research Institute** a new meat grading system for beef, goat's meat and pork was published in the *Gazette* on 8 May 1981 by the Minister of Agriculture and Fisheries. The new system has been radically simplified in comparison with the previous one and should be equally useful and comprehensible to the producer, the agent and consumer.

Shelf life of meat

In a study to evaluate three of the techniques generally used for carcass surface sampling the results of the agar sausage technique were found to be highly correlated with those of the excision technique, generally regarded as the most reliable technique.

WOOLLED SHEEP

An investigation was carried out in the **Karoo Region** to compare the various selection methods for Merino sheep.

The results of this study show the following:

- Objective selection methods are the most successful in increasing clean wool mass. Correction factors should be applied for sex, weaning status and progeny of the young ewes in respect of 120-day mass and only for weaning status in respect of 18-month raw mass and clean wool mass.
- Emphasis should be placed on fertility and mass for age.
- Young ewes should attain a body mass of 36 kg and all ewes should be in a positive mass balance to ensure a high conception percentage.

- The percentage of multiple births in the flock can be increased without reducing the production of the herd significantly.
- Pregnancy has a bigger effect on the production of the ewe than lactation.
- Ewes should not remain in the flock for longer than seven and a half years.

The Merino selection trial was continued at **Tygerhoek** with 500 breeding ewes divided into three groups. No selection is applied in the control group (200 ewes). Rams from this flock are made available to the industry for control testing on farms.

Results of the crossbreeding trial with woolled sheep carried out at **Nooitgedacht** show that the reciprocal crossings of Finnish Landrace are able to maintain an average fecundity of 229 % although the percentage of ewes that lambed did not differ significantly from the percentage in the other breeds. The daily mass increase up to weaning (210 g) was considerably lower than the average of 230 g per day, however. This lower mass increase may be ascribed mainly to the higher percentage of multiple births among the Finnish Landrace. The Border Leicester crossings produced the highest wool production per ewe, namely 7,8 kg per ewe per year.

The **Animal and Dairy Science Research Institute** carried out skin investigations on the reciprocal crossings. The results show that at 18 months of age there are no notable variations in the secondary to primary fibre ratio (S:%p ratio) among the different crossings. Where the Merino S:%p ratio is about 20 and the coarse wool types have a ratio of about 5, it is found that the crossings maintain an average S:p ratio of 10,66, which is, practically speaking, a middle value. There is a variation from 9,76 for the Cheviot crossings to 12,24 for the Merino Landsheep crossings.

Estimates of the genetic heritabilities for growth in the Dohne Merino were carried out at **Dohne**.

On the basis of the high h^2 -value for growth at 18 days, this age is regarded as a more suitable selection date for the Dohne Merinos than 100 days, which is used at present.

The phenotypic correlations between light wool properties and body mass do not show a major deviation from existing knowledge of the Merino.

The data from the development programme showed that birth status and secondly ewe age are the most important correction factors in the selection programme. The following adjustments should be made for twin births at 18 months:

- Body mass should be adjusted by 3,5 %
- Raw fleece mass should be adjusted by 4,0 %

At the same age the following adjustments should be made for the progeny of two-tooth ewes:

- Body mass should be adjusted by 2,3 %
- Raw fleece mass should be adjusted by 3,2 %

Quality studies carried out at **Grootfontein** on the degree and intensity of weathering of wool in

various farming areas of the Karoo Region indicate that the degree of weathering of the extreme tip (first centimetre) varies from 79,6 % to 92,3 %. The degree of deeper damage in the second centimetre of the tip varies from as little as 11,2 % to as much as 79,4 %. On the other hand an index number of about 20-25 % can be regarded as normal in the second centimetre for 12-month wool. There was also a relatively high percentage of even deeper damage, into the third centimetre of the tip. Indices varied from 6,5 to 42,1 %.

According to the results of the study the degree of weathering of Merino wool produced in the various farming areas of the Karoo is relatively high.

Wool from the bushiest areas such as the Eastern Karoo and the Succulent and Scrubveld shows less deeper damage - a fact that may be ascribed to the beneficial effect of the shade. Wool from the Central and North-Western Karoo was more weathered deeper in the staple. It is notable that the degree of weathering in second and third tip areas is considerably higher for wool shorn after the hot summer months. This confirms the supposition that wool that is long during the hot summer months and inclined to fall open is subject to deeper weathering. Shearing should be arranged in such a way that the wool is relatively short during the hot summer months.

Nutrition

At **Dohne** the sourveld was quantitatively and qualitatively improved by fertilising it with 60 kg of N + 12,5 kg of P per ha or overseeding the veld with lucerne. Although the treatments caused an increase of 20 to 40 % in the dry matter yield of the veld, the qualitative analysis of the veld showed an improvement of only 2 percentage units in respect of nitrogen. In overseeded veld lucerne contributed only 25 % to the total yield of dry matter.

The response of ewes and lambs to the improved veld was disappointing. However, lactating ewes were better able to maintain their mass. The maintenance of ewes and the growth of lambs may be improved by offering high protein licks on the improved veld. Energy licks improved wool growth on this veld. Lambs transferred from the improved veld to winter cereal pastures after weaning (2 months) are able to attain growth rates of 200 to 250 g per day. These autumn lambs can be marketed as early as August/September and were found to push up the income from the winter cereal pastures to as much as R400 per ha.

In the **Karoo Region** the utilisation by Merino sheep of lucerne hay and lucerne pastures at various stages of growth was investigated. The three groups of sheep received the following treatments:

- Lucerne hay under feedlot conditions (control group);
- grazing of lucerne at about 10 % flowering stage;

- grazing of lucerne at a height of about 15 - 20 cm

Results showed no significant differences between the average slaughter ages, slaughter weights, cold carcase weights and dressing percentages of the various groups. The carcase grading of the lambs on lucerne hay was considerably better than that of the groups on grazing. Wool production of the three groups was the same, namely 6,0 kg of clean wool per ewe.

It is apparent from the preliminary results that ewes given winter pastures (small grain) beforehand had a higher lambing percentage and that the wintering of ewes in the feedlot resulted in better growth and consequently higher weaning weights of the lambs.

Results obtained with lick supplements on various types of Karoo veld indicate that none of the protein or energy licks tested was economically justified. This was also true during the catastrophic drought of 1978/79.

Judging by the body mass increase of lambs, phosphorus supplementation has no advantages on Karoo pastures.

The effect of a relatively low and high nutritional level together with a high and low intensity of wool production on the attainment of puberty by Merino ewe lambs was investigated. The results of this investigation underlined the importance of adequate nutrition for sexual development and showed that the nutritional level has a significant effect on the occurrence of the first oestrus. Whereas all the ewes at the high nutritional level showed oestrus during the first breeding season (1963), irrespective of wool production, only 81, 89 and 66,7 % of the ewes at the low feeding level in the low and high wool production groups respectively showed oestrus during the first breeding season.

The investigation of the nutritional value of natural veld and the effect of supplementary feeding was continued in the **Free State Region**. The response of the sheep to energy and protein supplements is measured by body mass changes of the ewes and their lambs. However, additional information is also being collected on the pH of the rumen fluid, rumen ammonia concentrations, rumen volatile fatty acid concentrations and voluntary feed intake by the ewes.

The effect of sodium chloride (salt) on the performance of sheep on natural grazing is also being investigated. This aspect of supplementary feeding is important since salt is usually used to control the intake of licks by sheep. The results already indicate that a protracted high salt intake may have an adverse effect on the growth rate of young sheep. On the other hand the results indicate that a regular intake of 5 g per sheep per day on the grassveld at Glen is essential.

A relatively high degree of intensification can be attained in the sheep industry in the coastal areas of the **Eastern Cape**, as is reflected by the production data of breeding ewes at the Bathurst Experimental Station. This production system

depends on kikuyu, Rhodes grass and lucerne pastures and on an accelerated breeding and fattening programme with 8-month production cycles.

The accelerated breeding programmes (8-month breeding cycles) had a limiting effect on the production of ewes, however. Ewes in such breeding systems should not be kept past the age of 55 to 63 months. From the age of 15 to 55 months the percentage of ewes that lambed (of the ewes mated) increased from 69 to 87 %, the lambing percentage (of ewes that lambed) increased from 100 % to 118 % and the lamb weaning percentage (per ewes that lambed) increased from 70 to 107 %. From 63 months to 103 months of ewe age values for these important production characteristics decreased.

At **Nooitgedacht** soya bean kernels were tested as a supplement for adult dry Dohne Merino sheep for wintering on natural veld. The supplementation was given on a protein equivalent basis of 0, 30, 60 and 90 g of fishmeal per sheep per day and a treatment of 60 g of fishmeal was also included. Over the trial period of 16 weeks the respective treatments produced mass changes of -25, -10,4, -1,1, +2,2 and -0,2 % on initial mass. According to these results 112 g of soya beans per sheep per day (protein equivalent of 60 g of fishmeal) was sufficient to maintain the mass of sheep through the winter.

Soya beans were also evaluated as a protein source in creep and finishing rations for lambs and were included at 10, 20 and 30 % of the rations that contained 15 % crude protein. The high levels of soya beans caused diarrhoea in the lambs. No significant differences were found between the treatments.

Lambing seasons

Information on the desirability of autumn and spring lambing seasons was gathered at the extensive unit of the **Athole Research Station**. The lambing percentage in spring was 91 % as against 71 % in autumn, mortality was lower and growth better. At 18 months the average mass of the spring lambs was 42,3 kg, as against 33,4 kg for the autumn lambs. It therefore appears that a spring lambing season is more advantageous under extensive conditions.

PELT SHEEP

In addition to the black and brown studs, a white Karakul stud with about 100 ewes has been established at **Upington**. Numbers are being multiplied at present, after which strict selection will start.

A comprehensive study on the nutritional value of veld grazing for Karakul ewes has just been concluded at the Karakul Research Station. These results place the Department in a position to make well-founded recommendations on supplementary feeding.

An investigation of the water intake of Karakuls under veld grazing conditions has also been concluded.

A study on the ante-natal development of the follicle and fibre in the karakul by researchers of the Animal and Dairy Science Research Institute showed that the pipecurl type has the thickest skin, the longest and deepest follicles, the highest secondary to primary fibre ratio and the largest number of follicle germs. These characteristics were expected to diminish progressively as the curl became shallower, but they did not behave according to a fixed pattern.

ANGORA GOATS

The effect of hormone therapy on the inducement of sexual activity in Angora goat ewes in dioestrus was investigated. The best breeding response was obtained with MAP sponges + PMSG + HCG treatment. Treatment with MAP sponges + PMSG + LH-RH caused oestrus in the animals, but according to the results an active corpus luteum did not follow. The "LH-LV" treatment produced no breeding response.

MISCELLANEOUS

Ostriches

An investigation into the variation in the number of primary wing plumes of ostriches has finally been completed. The average number of plumes per wing is 36 and the co-efficient of variance about 3 %, which is very similar to the figures for the Duerden flocks of 1918. Although the number of wing plumes is not of direct economic importance, it is an important component of the feather yield. Feather mass is recommended as a selection criterion, but it is also necessary to guard against using breeding parents with low plume counts.

At Oudtshoorn the economic value of the skin, meat and feathers was evaluated on the live slaughter ostrich. The most important finding is that an average live mass of 73 kg promises a skin area of 120 square decimetres, on average, in normal growing conditions. It was also indicated that there is no economic justification for marketing ostriches with above-average quality plumes for slaughter purposes at an early age (at 73 kg) at the expense of a proper first pick, of plumes.

A study of hatching eggs again indicated that the age of storage eggs is the biggest single cause of the low hatching percentage generally encountered. Eggs should not be stored for longer than 10 days.

Horses

The increased interest of the past few years in heavy draught horses has continued and numerous inquiries about the availability of horses have been received.

In addition to the 12 breeding mares of the Elsenburg stud, 14 farmers' mares were covered.

The exceptional quality of the Elsenburg stud is widely recognised and at the Cape Show these animals again bore away all the important Percheron awards. However, the risk of the stud becoming too inbred has become so real that a breeding stallion (from the USA) will be imported. This stallion is expected in South Africa by the middle of 1981.

Game

The grazing habit of the kudu has been disturbed as a result of fencing with game-proof fences and serious problems with overgrazing are being experienced. The Glenconnor Study Group has determined that Valley Bushveld can carry 0,8 SSU of game per ha, as against the long-term carrying capacity of 0,78 SSU per ha.

On farms that are not fenced farmers find it difficult to rest 25 % of the grazing annually, as required by the Soil Conservation Act.

SUPPORTING RESEARCH

Ruminant nutrition

Nutritional value of the maize plant

There are several factors that affect the digestibility of maize straw. Studies at the Animal and Dairy Science Research Institute have shown that the digestibility of maize straw from as low as 40 % to over 70 %. This variation can largely be held responsible for the varying results obtained when maize straw is treated with chemical preparations to increase its digestibility. Studies in this connection are now being expanded to increase our understanding of the way in which the cell wall complex of maize straw is broken down in the ruminant digestive system.

Chemical treatment of low-grade roughage

A method of treating straw with caustic soda that is regarded as very effective in some overseas countries, the so-called Torgrimsy method, appeared upon thorough testing to be no better than simpler methods already known locally.

Meanwhile alternatives to caustic soda and ammonia for the treatment of straw were also investigated. Although treatment with sodium and calcium hypochlorite produced a considerable improvement in the digestibility of sunflower hulls and wheat straw, the treatment costs were excessively high in relation to the improved digestibility.

Straw can be most effectively treated by chemical means when sufficient water is used to wet the straw completely (5 l/kg of straw). This wet matter is highly fermentable, however, and therefore does not keep long; indeed the highest digestibility is attained 48 hours after treatment and digestibility then drops within a week to the original value before treatment. However, suitable preservation methods are being investigated at present.

Utilisation of broiler manure

Overseas methods of ensiling broiler manure together with straw or maize silage are being tested. The advantages of ensiling are that it is a fairly cheap method of sterilising the chicken manure. The product is also very acceptable to ruminants.

Variation in voluntary feed intake

Experimental work at the ADSRI strongly indicates that more attention should be paid to the differences between animals in respect of voluntary feed intake as a cause of differences in production performance and efficiency. There is good reason to think that certain breeds are poor eaters. This matter is undergoing further investigation.

Research on the effect of concentrates on roughage intake is receiving a considerable amount of attention. In both cattle and sheep the intake of digestible energy increases as more and more concentrates replace roughage in the diet, up to a point, after which the intake of digestible energy remains constant or even starts dropping.

This point of maximum energy intake appears to be common to various kinds of roughage, but is found to be different for different sources of roughage in various concentrates: roughage rations. It was again found that in cattle hay intake drops in direct proportion to the increase in the intake of concentrates. This phenomenon sometimes means that feed mixtures that produce the fastest growth in cattle and sheep are not the most economical.

Basic studies of feed flow through the digestive system of the ruminant are in progress at present and have already revealed valuable facts. It is now clear that the extent to which a ruminant's rumen is filled is closely linked to the type of ration and possibly also to pretreatment. Rumen filling is in turn very closely linked to voluntary feed intake and efficiency of feed consumption. A useful model has been drawn up in which these relationships are used to estimate in advance an animal's performance on particular kinds of food.

Rumen biochemistry and microbiology

Basic techniques for studying the nutritional requirements of rumen micro-organisms have been developed. It has been possible to show with the aid of these techniques that rumen pH is not the only factor that hampers the growth of certain organisms. Studies on the mineral requirements of rumen micro-organisms are in progress at present and have already shown that Na^+ cannot affect rumen fermentation within the limits of the conditions that could possibly occur on farms. This work will be extended to other minerals.

Intermediary metabolism

Research on fat metabolism in sheep has received considerable attention owing to the close relationship it bears to metabolic disturbances such as domsiekte. Interesting differences between cattle and sheep have been observed and these may

already partly explain certain recorded phenomena. The investigation is being taken further, up to the level where the metabolism of isolated fat cells is studied *in vitro*.

ANIMAL GENETICS

At the laboratory of the **Population Genetics Section** animals are used as biological models for animal breeding problems and a selection experiment with white rats for certain growth parameters and efficiency functions is being carried out at present. Preliminary results indicate that progress in breeding for growth rate can really only take place as a result of a change in end mass, which may explain why selection for growth rate generally leads to an increase in the degree of fatness of adult animals.

Chromosome studies

Psychogenetic investigations have revealed a chromosomal deviation that has a major effect on fertility in cattle owing to embryo death or abortion.

Although the indigenous cattle of Southern Africa are classified as *Bos indicus* on the basis of their anatomy, physiology and adaptability, chromosome studies have shown that the cattle breeds of Southern Africa probably had a male ancestor in common with the European *Bos taurus* cattle, but that the phylogenetic root was through Africa. This is confirmed by biochemical-genetic markers, of which the haemoglobin I band which occurs only in Africa is a typical example.

BLOOD TYPING

Forty-six reagents are being used together with biochemical polymorphism for the routine blood typing service. During the period under review 3 667 blood samples were received, made up as follows: 149 calves were subjected to 1 000th calf check tests and 265 calves were presented for determination/confirmation of parenthood. Determination of parenthood was carried out on 65 calves bred by means of embryo transplants. In addition 2 487 breeding bulls and 28 pairs of bullcalf-heifer twins were subjected to blood typing. Only three heifers were declared fertile.

DAIRYING

Milk

When the Dairy Control Board introduced a milk purchasing scheme based on fat, protein and microbiological content on an experimental basis for a year, the Animal and Dairy Science Research Institute was involved in an advisory capacity, in addition to exercising technical control.

The hygienic quality of South African market milk has been investigated and a report has been submitted to the interested instances.

The results of shelf life tests indicated that the increase in the total bacterial count during 5 days

of storage at 7°C gives a good indication of the shelf life of perishable dairy products.

The shelf life of pasteurized milk, cream, yoghurt and other perishable dairy products was sometimes inadequate and can be improved through elimination of post-process contamination from fillers, pipes, etc.

The Institute also found that only 5 of 22 detergents and disinfectants for cleansing dairy equipment tested, conformed to the test requirements of the S.A. Bureau of Standards.

The Institute was also involved in setting microbiological and chemical standards and designing standard analytical methods. It was established that the amido black method of protein determination produces reliable results that can be successfully used for purchasing systems by the smaller dairy factories to replace the far more expensive infra-red techniques.

Referral and screening methods for tracing inhibitors in milk were investigated and a pamphlet was drawn up for use in practice. The level of iodine in milk in its natural form and as a result of contamination from iodophore disinfectants is being determined on a regional basis at various points from milking to reception at the factory.

The adenosine triphosphate bioextraction technique is used as a method of determining the total bacterial count in milk and several variations on this technique are being investigated in order to attain greater reliability. In the course of an investigation into a suitable method of tracing milk powder that has been added to milk it was established that amido black and turbidity tests are not adequate for the purpose and electrophoresis techniques are now being investigated as a possibility.

Investigations into the bacteriological spoilage of ultra-high temperature treated (UHT) milk have shown that extremely heat-resistant proteolytic enzymes of some *Bacillus* races and non-spore forming psychrotrophic bacteria may be responsible for flavour and coagulation defects.

Purified protease enzyme fractions showed high specificity in respect of all the casein fractions and whey proteins. In some cases UHT treatment was responsible for a reactivation of these enzymes. Attempts are being made to correlate instability of UHT milk (coagulation) during storage with the degree of browning of such milk.

Cheese

Studies were carried out on various strains of lactic acid starter bacteria to improve the available strains via genetic manipulation. The improvements aimed at were high lactate production and antibiotic and bacteriophage resistance. Some success was achieved in the above aims but cheese trials showed that the flavour producing characteristics of the manipulated bacteria were unstable. An attempt is being made to rectify this matter.

Studies were undertaken to gain some knowledge of the number of enteric bacteria in cheese. The results were used to suggest microbiological standards for cheese manufactured under local conditions.

Work was done on Feta cheese production and the use of vacuum packaging as against packing in brine in tins was experimented with, with promising results. The advantages of vacuum packing are that salt content can be better controlled and the product that has to be transported for distribution is less bulky.

Aspects of whey processing also received attention. At present specialised whey products are being imported into South Africa.

For factories where only small volumes of whey are involved, work has been concentrated on the recovery of whey protein by denaturation and separation by means of a decanter developed at the Institute.

The whey protein concentrate containing 15-25 % total solids and 8-15 % pure protein was also examined for possible use as a meat replacer or extender in certain processed meat products. This method of utilisation has proved successful and has been tested by commercial producers of processed meats with satisfactory results. Owing to the low cost of production of this protein, the production costs of certain processed meats could be reduced without reducing the nutritional value of the product. Up to 30 % of the meat could be replaced by whey protein in certain products.

Butter

Work has been continued on the low-fat butter spread reported on in 1980. A formulation and manufacturing procedure has been decided on and the keeping quality of the product determined. Experimental batches have been manufactured at factories but difficulties have been experienced with a slight syneresis, and the cause of this defect will have to be investigated before putting the product on the market.

Milk powder and other products

The Institute is investigating several analytical techniques in respect of the bacteriological and chemical composition of milk powder. An attempt is being made to work out a suitable method for determining the presence of *Staphylococci* in dairy products, and lay down standards. *Tetrahymena pyriformis* W is being used in preliminary screening of dairy products before the biological determination of the nutritional value is done with rats. Gas chromatographic techniques of determining milk powder in bread are being investigated. Better techniques for determining iron in dairy products are receiving attention.

Because of available facilities in the Dairy Technology Section of the Institute, work on the utilisation of blood for human and animal nutrition has been started in collaboration with the Meat Technology Section. Methods of hygienic collection

at the abattoirs, plasma separation and dehydration have been investigated and the nutritional value of spray dried blood has been found to be 40 % higher than that of blood meal being manufactured in the conventional method.

As a result of this work the hygienic collection of the blood and processing methods are being considered by the abattoir industry.

DAIRY AUXILIARY SERVICES

Quality improvement laboratory

During the year under review the following products were judged on quality and keeping quality:

TABLE 1

Dairy product	Number of samples
Butter	350
Cheese	100
Milk powder	6
Cottage cheese	61
Yoghurt and cottage cheese	200
Pasteurised milk	500
Ultra-high temperature treated milk	547
Ice cream	21

In general butter had a good bacteriological quality upon receipt, but there was considerable deterioration after a keeping period of seven days at 20 °C, which is indicative of a poor keeping quality. Poor moisture distribution occurred and control over the percentage moisture and the percentage salt was not satisfactory. Oxidation of the fats was also marked.

The results of analyses of both Gouda and Cheddar are indicative of considerable variations in composition. A total of 12 % of the samples did not comply with the legal standards of a minimum of 48 % fat in the dry matter.

The milk powders were of a good chemical and bacteriological quality. The bacteriological quality of cottage cheese was not satisfactory. The microbiological quality of the yoghurt was good.

The bacterial counts of pasteurised milk were too high in general. Further work showed that these unsatisfactory results may be due to poor quality raw milk. A count of over 10 000 000 bacteria/ml is often found in the milk of some raw milk suppliers.

Pasteurised milk was also analysed to determine which organisms are responsible for the spoilage of the milk under refrigerated conditions. The preliminary results indicate that lactic acid bacteria (*Streptococcus* species) and *Pseudomonas* species can produce this deterioration.

The results of the analyses of UHT milk indicate that 23 % of the samples contain one or more types of bacteria. By law this type of milk may not contain any bacteria. Flavour defects included burnt, acid and in some cases bitter flavours. Some specimens were thickened as a

result of excessively high acidity and sweet curdling was occasionally present.

The flavour and quality of ice cream were good in general. However, the percentage of fat in the ice cream was too low according to legal requirements.

Extension to the industry

Extension on milking methods was provided for the primary dairy industry, mainly from Elsenburg. Matters that received attention included the following:

Milkingstall complexes, the installation and testing of milking machines, milking hygiene, the occurrence of a low fat content in milk and the incidence of rancidity and tracing of its causes.

Extension for the secondary dairy industry, mainly from Irene, included the following:

The planning of a whey utilisation complex in the Western Transvaal, visits to several creameries and cheese and fresh milk factories experiencing quality problems, the drawing up of analytical standards and regulations and the checking of analytical procedures for control laboratories, provincial administrations and local authorities.

Training of dairy technologists

Tecnologists for the dairy industry are trained at the Glen College of Agriculture. A total of 58 students took the following training courses:

1. Advanced course in dairy technology
2. Milk testing
3. Milko testing course
4. Cream testing

Short courses in dairying

In addition to the short courses presented at Glen, short courses on the principles and handling of the infra-red milk analysers are presented at Elsenburg and Irene.

LIVESTOCK AND PASTORAL PRODUCTS IMPROVEMENT SCHEMES

NATIONAL DAIRY CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

The Dairy Cattle Performance and Progeny Testing Scheme

The number of herds undergoing testing increased again, namely from 1116 to 1171, and the number of cows tested per month rose from 60 306 to 64 473. 84 200 individual production records were released to members of the Scheme, as against 77 613 the previous year. 766 318 milk samples were tested for butterfat, protein and lactose by means of infra-red analysers in five regional laboratories.

The average production per cow per lactation is shown in Table 1.

TABLE 1 - Average production per cow per lactation*

	Registered		Grade	
	1975/76	1980/81	1975/76	1980/81
Number of cows	12 827	20 617	30 246	43 856
Milk (kg)	3 920	4 505	3 821	4 133
Butterfat (kg)	162	174	141	154
(%)	4,13	3,87	3,70	3,71
Protein (kg)	-	154	-	139
(%)	-	3,42	-	3,35

*The Frisian breed represented 72 % of the total number of cows.

The productions of 53 cows that broke national records were checked.

The Dairy Cattle Progeny Testing Scheme

A total of 34 Frisian, 7 Jersey, 2 Ayrshire and 4 Guernsey bulls were presented for testing in 1980. 15 389 control cows from 355 herds were presented for the evaluation of the bulls. The first lactations of the daughters of the test bulls have now been completed.

Publications

The following publications appeared during the year under review:

1. Annual report for registered and grade Frisians, Jerseys Guernseys, Ayrshires and other breeds, Parts 12 and 13.
2. Official bull analysis, Parts 8 and 9.

BEEF CATTLE PERFORMANCE TESTING SCHEME

Requests to participate in the performance testing scheme increased as a result of the revival that has taken place in the meat industry during the past year. All the bodies involved in the meat industry displayed renewed interest in the various phases of the scheme and offered their co-operation. The special performance testing class for young phase C tested bulls at the Pretoria Show was an example.

An additional 116 members joined the scheme, bringing the total membership to 1 358.

Table 1 shows the number of bulls tested at several centres under the various phases.

Phase D tests on farms in the RSA increased by 20,5 %.

A total of three progeny testing groups were subjected to carcase evaluation (phase E) during the past year.

PERFORMANCE TESTING OF WOOLLED SHEEP

This scheme is now firmly established. During the year under review a record number of 34 036 wool samples from sheep were analysed and

TABLE 1 - Number of bulls subjected to growth tests - 1980

	Bulls tested	
	1979	1980
1. Departmental centres (Phase C)		
Irene	305	334
Vryburg	275	291
Queenstown	149	179
Cedara	166	165
Omatjenne (S.W.A.)	25	37
2. Non-Departmental Centres (phase D)		
Potgietersrus	141	146
3. On-the-farm tests (phase D)		
Republic	1 668	1 992
S.W.A.	119	92
Total	2 848	3 236

production data tested at the Fleece Testing Centre.

It is notable that increasing numbers of breeders are providing more complete records. Proper records enable the Fleece Testing Centre to make the corrections and calculations required for more efficient selection of breeding animals. It can rightly be said that this scheme is the most sophisticated one for woolled sheep in the world at present.

PERFORMANCE TESTING OF MUTTON SHEEP

The good demand and increased prices for all grades of lamb, mutton and goat's meat have stimulated interest in the Mutton Sheep Scheme. During the year under review the data of 15 076 lambs received from 104 breeders, were processed. The highest numbers of the following breeds participated in the scheme: the S.A. Mutton Merino (6 800 performance-recorded lambs, the Dorper (3 200) and the Dormer (1 500).

THE NATIONAL PIG PERFORMANCE AND PROGENY TESTING SCHEME

The Pig Recording and Health Phase

The membership of the Pig Performance and Progeny Testing Scheme for 1980 was 41 active members, as against 47 in 1979. The number of litters recorded during the year increased from 3 877 in 1979 to 4 359 in 1980, however. This is largely due to the increase in Large White litters.

Boar and sow performance testing phase

Cedara, Elsenburg and Irene received 426, 638 and 844, boars, respectively for testing. Of the total number of boars that completed the test, 43 % were Large White Boars.

Boar testing is given preference over sow testing because boars have a far bigger influence on herd improvement. During 1980, 11 sows (bred from imported semen) were tested at Irene to gain an indication of their potential.

Test results

In the case of the S.A. Landrace the average age from birth to 86 kg of live mass remained unchanged at 139 days, but in the case of Large White this average dropped from 136 to 134 days. With regard to the average feed conversion, both the S.A. Landrace and the Large White showed a small decrease. The S.A. Landrace decreased from 2,78 to 2,77 and the Large White from 2,59 to 2,58. The same applies to the C+K fat measurements - the S.A. Landrace dropped from an average of 37 mm to 35 mm and Large White from an average of 34 mm to 33 mm.

POULTRY PERFORMANCE TESTING

Egg production tests

At the conclusion of the 1979/81 egg production tests a hen-housed average production of 266,6 eggs per hen was obtained at Glen and a hen-housed average of 226,6 eggs per hen at Irene. In the broiler test at Irene an average live mass of 1973 g per chick at eight weeks of age was obtained.

Poultry multiplication scheme

During the year under review one local breeder imported 18 000 broiler parents.

ANIMAL HEALTH

ONDERSTEPSPOORT INSTITUTE OF VETERINARY RESEARCH

The Institute is engaged in veterinary research, diagnostics and vaccine production primarily in connection with food animals. In addition, technical advice is provided on Stock Remedies under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947) and to some extent extension work is done for the farming community.

Eight new facets (projects) were registered as part of the research programme of the Institute, 3 were finalized. There are 144 current projects. A total of 49 scientific publications by staff members of the Institute were published during the 9-month period up to the end of March 1981.

VETERINARY RESEARCH

DISEASES OF CATTLE

Bacterial diseases

There was a notable increase in the incidence of colibacillosis in calves as a result of the absence of a specific strain in the Onderstepoort vaccine. This strain has now been added to the vaccine and hopefully it will solve the problem. After numerous attempts a vaccine against anthrax has been successfully prepared in liquid medium. Although production has not yet been tested in large

volumes, a production batch has been prepared and is being issued. This breakthrough may prove most valuable in mass production.

Tests were carried out on mastitis remedies registered under Act 36 of 1947 as Stock Remedies to determine whether the excretion period of the marker dye in the remedy had been synchronized with that of the antibiotic in the remedy as required. It was found that the dye, Food blue No. 4, could only be determined spectrophotometrically to the relatively high concentration of $1,0 \times 10^{-4}$ mg/m^l of milk.

In addition, it was established by an *in vitro* sensitive bacteriological test that the above products containing penicillin do not measure up to the registration requirements that the dye must only disappear from the milk after all the antibiotics have been eliminated from the udder.

Investigations had shown that the cow's udder has an amazingly effective defence mechanism against mastitis, even when individual quarters have been affected by septic mastitis. During active lactation mastitis lasts a relatively short time and it usually stems from infections of the teat canal. Control and prevention of clinical mastitis must, therefore, be aimed at teat canal infection.

Stress as a result of cold weather, subnormal temperatures in the udder, low levels of milk glucose and increased corticoids may seriously affect the efficacy of the leucocyte udder barrier. This is especially the case when bacteria such as *E. coli* and other coliform micro-organisms which are adaptable to such conditions in the udder, and are therefore not readily affected by such conditions, are present.

Rickettsial diseases

Research on heartwater is making good progress. All previous attempts to culture the organism artificially had so far failed. This seriously interfered with the development not only of an effective vaccine but also of a reagent or antigen for seriological tests. Adaptation of the organism to mice, the consequent availability of an antigen and the development of the fluorescent-antibody - technique following on this, constituted the first real progress made in the development of a technique for establishing whether an animal had been naturally infected with the organism by the tick. With this technique it is possible to determine what percentage of animals have been exposed to natural infection, whether they are still susceptible to the disease, and it is therefore pre-eminently suitable for the study of the epidemiology of heartwater. Effective control and prevention of the disease are only possible with a fundamental knowledge of the epidemiology of the disease.

Infertility and venereal diseases

The investigation of perinatal losses was pursued with the examination of 147 foetal specimens (18 % more than in the previous year)

with the following results:

	% Farms infected	
	1979/80	1980/81
Brucellosis	12,1	14,3
Q Fever	0	2,0
Campylobacteriosis	0,8	0,6
Chlamydiosis	6,4	2,7
<i>Corynebacterium pyogenes</i>	7,2	6,1
<i>Salmonella dublin</i>	0,8	0
<i>Pasteurella haemolytica</i>	0,8	0
Anaplasmosis	0,8	0

The number of cases in which the cause of abortion could be determined is, as before, rather low (21 %) and gives rise to the suspicion that viral infections may possibly be involved as an important causative factor.

Out of the 1 231 sheath washings of privately-owned bulls investigated, 7 % were positive for trichomoniasis and 3 % for campylobacteriosis. Vaginal mucus specimens of 223 cows were examined and several proved positive for *Campylobacter*, *Brucella* and *Corynebacterium pyogenes*.

A total of 38 059 cattle serum specimens (61 % more than before) were submitted to the rose bengal test for brucellosis and 13 % were positive. In similar tests in which all 3 tests, the rose bengal, the serum agglutination and the complement fixation tests, were used for the investigation of the occurrence of false negative rose bengal results, it was established that such results may be considerably reduced or ruled out altogether if the tests are carried out with fresh serum that has been kept on ice.

An examination of 1 325 serum specimens of cattle being tested for 7 different *Leptospira* specimens led to the conclusion that *L. pomona* and sometimes *L. hardjo* may be the causes of abortion storms.

Protozoal diseases

A new, hitherto undescribed, *Babesia* species (redwater parasite), which affects cattle, was isolated from a bontlegged tick (*Haemaphysalis marginatum rufipes*). It is intermediate in size between the known two South African redwater parasites and, though morphologically it cannot be distinguished with certainty from them, it can be identified serologically. It is widely distributed in the Transvaal and Natal; its virulence for cattle is so low, however, that it is apparently of no economic importance.

An analysis of the sales of redwater vaccine over a period of 3 months indicates that 85 % of this particular vaccine goes to areas where *Babesia bovis* (Asiatic redwater) is the most important cause of stock losses. Efforts to develop a vaccine which, like heartwater blood, can be stored frozen in liquid nitrogen look promising. Promising results have also been achieved with an attenuated Australian strain of *B. bigemina* as vaccine.

Further serological investigations into the status of redwater on representative farms in the

Northern Transvaal and Natal were carried out. *Babesia bovis* (Asiatic redwater) was encountered on only one third of the farms in the Potgietersrus-Waterberg area in an enzootic unstable situation and it would appear that the vector tick of the disease cannot establish itself successfully in this area. On the other hand, the position with regard to African redwater was very much more stable.

Though there was a similar position in the Ubombo-Hlabisa district, this is one of the most enzootically unstable areas with regard to both the infections being investigated.

Excessively good tick control was the cause of instability in all cases. For some reason or other, 33 % of cattle, routinely inoculated with gallsickness vaccine apparently do not react and thus do not become immune to the disease. The reason for this is still being investigated.

The presence of nagana (trypanosomiasis) in a localized, thickly-wooded area in northern Zululand is no new phenomenon. A survey in the vicinity of the Mkuze Game Reserve established that nagana constitutes a local farming problem in cattle which mostly become infected if they wander into the Reserve and the contiguous Nquala area. Debility and anaemia are the most conspicuous symptoms of the disease.

It is recommended that farmers in this area be made aware of the problem, that the occurrence of the disease be monitored and that animals suspected of having the infection be treated with diminazene.

External parasites

It has been shown experimentally that the Shaw tick larval test being used by some organizations to indicate tick resistance against acaricides in a specific area is not as reliable as originally presumed. The so-called Drummond test for adult ticks gives much more repeatable results.

Although the control of river midges by means of water manipulation in large sections of the Vaal and Orange River systems can be effected with ease, problems have been experienced in some areas. Especially in the deeper parts of the rivers, in rapids and water chutes situated too far from dams for a meaningful change in water level, this technique is ineffective. The possible limited use of effective pesticides such as temephos is being considered. An interesting sidelight on this problem species in South Africa is that the female can produce her full complement of eggs after a single blood meal, unlike the stable fly which must have blood daily. A further observation confirms that egg development only takes place if the water they are deposited in is rich in oxygen.

Rhipicephalus zambeziensis, a tick closely related to the brown ear tick, has been encountered in the warmer, drier areas of the bushveld. The practical importance of this tick species is being assessed.

Internal parasites

The following are fresh discoveries from the surveys and study of parafilariosis (false bruising):

In the 6-8 tooth class the incidence of infestation is considerably higher in bulls than in cows and oxen.

As a rule bulls also have a greater number of lesions than oxen and cows, and the lesions cover a larger surface. It seems clear that the bull, either because it is more susceptible or more exposed to the parasite, or because there is something that favours the longevity of the parasite, generates a greater worm burden than other animals. It is also interesting that older oxen have fewer and smaller lesions than younger animals.

Only in the case of the Africander and Brahman breeds was comparison numerically justified: The Africander was significantly more infested (8,7 %) than the Brahman.

Research on liver fluke (*Fasciola hepatica*) has demonstrated that the mouse is a very suitable experimental animal for this important parasite. Through mice it has been shown that the infectivity of metacercaria at an age of 4 weeks is maximal (90 %), and that this high level is maintained for as long as 28 weeks (still 80 %). Even at 44 weeks the parasite is infectious (40 %). This discovery has important practical implications for the farmer.

Poisoning

Strychnine poisoning in dogs and cats accounted for a total of 34 % of the positive cases of poisoning diagnosed at the Institute. Next in order of importance were chlorinated hydrocarbon and organophosphorus poisoning (31 %), while 15 % of the cases could be ascribed to lead, arsenic and urea poisoning (approximately in even proportions).

DISEASES OF SHEEP AND GOATS

Bacterial diseases

Regarding epididymitis, the important organism, *Pasteurella haemolytica*, involved in bacterial diseases, was encountered in practically every important sheep-farming district. Special techniques demonstrated that an extremely low infection if *Streptobacillus moniliformis* can also cause this condition.

It was established that polyvalent vaccines against *Pasteurella multocida*, which comprise more than 4 strains, are not effective because of antigenetic competition. The current vaccine for cattle and sheep was consequently separated into 2 vaccines, one for cattle and one for sheep, each of which contains 4 strains.

Lambs 2-3 months old, it was found, did not react as satisfactorily to a single injection of the oil adjuvant toxoid vaccine against pulpy kidney (enterotoxaemia) as adult sheep. The problem, however, may be solved with 2 injections: oil adjuvant followed 4 weeks later by an alum-precipitated toxoid. This procedure provides

protection for 8 months, after which a yearly booster dose of the alum vaccine gives the desired immune status.

Viral diseases

A world breakthrough has been made with jaagsiekte in that for the first time it could be demonstrated that a type of retrovirus, encountered in the lung washings of affected sheep and detectable by electron microscopy, is involved in the aetiology of this lung cancer. A positive correlation was found between the concentration of the said virus and the incubation period in the transmission of the disease to lambs. The disease, which usually has an incubation period of 12-18 months, can now be produced with 80 % certainty within 4-6 weeks with concentrated viral preparations.

Attempts to culture the virus *in vitro* are proceeding, and in addition, a beginning has been made with characterizing the virus in an attempt, *inter alia*, to develop a serological test for carrier of the disease.

Internal parasites

A new worm remedy, praziquantel, was successfully tried out against the bladder worm stage of the canine tapeworm, *Taenia multiceps*. The dose applied in sheep was high and though unfortunately it is too expensive for treating animals on a flock basis, it can possibly be considered for valuable stud animals. Testing of the remedy at lower dosages and of fenbendazole at very high dosages are envisaged.

Poisoning

Further research on tribulosis (geeldikkop) has revealed that proven, non-poisonous dubbeltjies (*Tribulus terrestris*) plus sporidesmin (the poison of the fungus *Pithomyces chartarum*) gives rise to typical tribulosis. Apparently there is a fraction in the plant which induces crystal formation and this clogs up the bile ducts of the sheep.

On the other hand, dubbeltjies, together with other known liver poisons such as *Senecio* plants, green algae and the lupin fungus *Phomopsis*, cause intoxication typical only of these poisons, and not tribulosis.

Several experiments carried out with extremely poisonous strains of the maize fungus *Fusarium moniliforme* in conjunction with co-workers of the Faculty of Veterinary Science have established that this widespread fungus can lead to serious lung toxicosis in pigs and to liver and kidney damage in sheep.

Chemical examination of *Tylecodon* (*Cotyledon grandiflorus*), one of the plakkie species responsible for nenta or krimpsiekte in small stock, resulted in the isolation of 2 cardiac glycosides of the bufadienolide group.

DISEASES OF PIGS

Bacterial diseases

As with calves, two strains of *E. coli*, which were not included in the vaccine, resulted in a marked increase in the incidence of colibacillosis in pigs. The vaccine was changed and it is hoped that the new vaccine will have the desired effect. In an experiment the Onderstepoort vaccine compared very well with 2 imported vaccines.

Viral diseases

Further work on the epidemiology of African swine fever has established that a high viraemia occurs in young warthogs and that it is through them that tsetse flies (*Ornithodoros* sp.) become infected. Infectivity increases with the size and age of the tsetse flies. With refined techniques it could also be demonstrated that the infection in tsetse flies is probably considerably higher than that shown with other techniques previously.

A more acceptable explanation of how swine fever finally emerges in domestic pigs is now gradually being formulated by these findings together with those of other workers. They showed that warthogs often eat tsetse flies and also that the younger stages of these parasites, contrary to what was thought previously, often attach to the host and are carried out of the burrows.

Continued research has shown that a low grade infection with swine fever in warthogs occurs in the Mkuze Game Reserve in Natal but not in the Hluhluwe and Umfolozi reserves. On the other hand a high grade infection not only occurs but is widespread in South-West Africa (Namibia).

DISEASES OF POULTRY

Bacterial diseases

Attempts to produce a more effective vaccine against infectious coryza in poultry are meeting with some success.

Abdominal dropsy (ascites)

This is an important new condition of unknown origin and it occurs exclusively in broilers after the age of 7 days. The first symptom of the condition is damage to the right heart muscle which leads to systemic congestion of the liver and other internal organs with consequent severe subcutaneous oedema and deaths.

The disease only occurs at an altitude of 1 000 m or more above sea-level and its incidence is highest during the winter months. In the very cold parts of the Highveld such as Potchefstroom and Standerton half of all mortalities in the winter are attributable to ascites. An estimate based on mortalities experienced by the bigger broiler organisations revealed that more than million broilers died last winter from this condition.

All attempts at arriving at the cause of this condition have so far been negative, but diagnostic work is proceeding.

DISEASES OF HORSES

Protozoal diseases

Good progress is being made with the development of a serological test to investigate the two types of biliary fever (*Babesia* spp.) to which horses are exposed in South Africa.

Out of a total of 2071 specimens tested for dourine, 40 proved positive and 15 were suspect. The positive cases originated from the Transvaal, Free State and Natal as well as from South-West Africa (Namibia), Zimbabwe, the Transkei and Bophuthatswana.

DISEASES OF SUNDRY ANIMALS

Viral diseases

A total of 3 171 specimens from large outbreaks of rabies were examined, that is, three times as many as were examined in the previous year. Of these 331 specimens were submitted from South-West Africa (Namibia) and 5 from Oman, Swaziland and Botswana. Of the 688 positive cases (22 % of the total), 152 originated from South-West Africa (Namibia). Out of the 536 cases in the Republic, 187 were from Natal where a rather serious outbreak had occurred.

Rabies in kudu in South-West Africa (Namibia) had increased dramatically during the year, and 67 cases in wild ruminants (practically all kudu) were diagnosed. Indications that the infection spreads horizontally from kudu to kudu are supported by the following observations:

1. The incidence had increased only in kudu and not in other in-contact wild buck species.
2. Spread of infection in kudu was restricted by a game fence which did not restrict the movement of the usual vectors such as dogs and jackals.
3. Salivation is a characteristic symptom in kudu.
4. Kudu often lick one another.
5. Since kudu are browsers and often feed on thorn bushes, they frequently have small mouth wounds.

Artificial infection, carried out in conjunction with the Division of Veterinary Services in South-West Africa (Namibia), has demonstrated that kudu are extremely susceptible to rabies. Rabies was produced in 2 out of 4 cases by just dropping infected saliva from a kudu with clinical symptoms into the mouths of healthy animals.

An attempt is being made to develop a practical way of immunizing kudu against rabies. Adding the vaccine to drinking water unfortunately gives very poor results. Intranasal application gives positive results, and kudu react to intramuscular inoculation much like cattle, but the limiting factor is a practical technique of administering the vaccine under field conditions.

A total of 288 bat specimens from Natal were examined and in 9 cases (all of them in fruit bats, *Epomophorus wahlbergi*) fluorescent antibodies against rabies were found. The virus could be

isolated in 3 cases. The fluorescence test, however, is a group specific test, and preliminary indications are that this is not a typical rabies virus, although it is lethal for dogs and guinea-pigs.

The tissue culture production of rabies vaccine initiated last year made it possible for the enormous increase in demand for the vaccine resulting particularly from the outbreak of the disease in Natal to be met. The normal production of 300 000 doses per year shot up to 1,5 million in the current year. It was for this achievement that a National Productivity Award for 1980 was presented to the Institute.

TECHNICAL RELATIONS WITH
OTHER COUNTRIES

Liaison and co-operation with
African countries

Seven scientists from African countries visited the Institute during the year, namely, from Zimbabwe, Malawi, Swaziland and Lesotho.

Various neighbouring countries and others received 8,75 million doses of vaccine from the Institute through official channels.

There was an notable drop in the number of specimens submitted for diagnoses from abroad, as the following table shows:

Country of origin	Number of specimens		
	1978/79	1979/80	1980/81
South West Africa			
(Namibia)	429	1 211	249
Botswana	276	213	45
Lesotho	33	48	5
Swaziland	173	187	27
Zimbabwe	133	102	4
Malawi	8	51	0
Zambia	0	22	5
Mauritius	16	15	0
Other	61	13	1
	1 129	1 862	336

This drop is probably chiefly attributable to the development of diagnostic facilities in the countries themselves (for example, in South-West Africa/Namibia); or the drop may be wholly incidental but it may also be political.

Liaison with overseas countries

Thirty-seven scientists from overseas paid short visits to Onderstepoort during the year, and, in addition, 153 foreign tourists visited the Institute.

As a world reference centre for horse sickness and bluetongue, Onderstepoort assisted Togo, Israel, Uruguay, France, Swaziland and Zimbabwe in testing serum- and other specimens, and in providing reagents. Reagents for Rift Valley fever tests were also made available to Botswana and Zambia.

Overseas study tours

A total of 5 short overseas visits were

undertaken by officials of the Institute.

VACCINES AND STOCK REMEDIES

VACCINE PRODUCTION

General

More than 180 million doses of vaccine were issued during the year under review the largest quantity of vaccine ever to have been produced by the Institute. It should be pointed out that this figure represents the full capacity of the factory and any further increase will demand an over-utilization of the space, facilities and personnel.

The record production can primarily be accounted for by an increased demand of Enterotoxaemia (8 million doses); *Brucella* S19 (1 million doses); Anthrax (7 million doses); Quarter evil and quarter evil/botulism (3,5 million doses); Rabies (1,2 million doses); Infectious laryngotracheitis (6 million doses); Newcastle disease (3,3 million doses); *Pasteurella* (cattle) (3 million doses)

As in the past; a large quantity was supplied to foreign countries, which this year amounted to approximately 5 % of the total production.

	1979/80	1980/81
Botswana	296 783	469 650
Lesotho	156	-
Malawi	172 600	456 200
Zwaziland	400 455	81 352
Zambia	6 313 113	5 196 800
Zimbabwe	3 840 668	1 161 260
Israel	1 232 500	785 000
Reunion	1 000	-
Mocambique	100 000	-
Bophuthatswana	34 023	40 030
Transkei	62 277	26 863
Venda	25 040	25 040
SWA (Namibia)	1 085 858	504 652
	13 664 473	8 746 847

The quantity of Onderstepoort vaccines which was traded in overseas countries, is not known and was not taken into consideration.

Virus vaccines

Apart from the general increase in production, the most striking increase was rabies vaccine, from 484 538 doses in 1979/80 to 1 683 811 doses in 1980/81 an increase of some 350 %. This achievement could only be accomplished by a timeous change in technique and exceptional dedication of the personnel who were involved.

The decrease in the issues of certain poultry vaccines continued and can probably be explained by increased importation.

Bacterial vaccines

Two new vaccines viz against erysipelas in pigs and pasteurellosis in cattle were introduced. The demand for the former was moderate but in

the case of the latter even a production of 3 million doses was inadequate.

Protozoal and rickettsial vaccines

No particular changes occurred except that there was an increase in the issues of heartwater blood and especially of elephant skin disease vaccine.

Antigens and antisera

The present range of diagnostic antigens was extended with the addition of an antigen for the serological diagnosis of dourine. There was also a marked increase in the issues of therapeutic antisera.

TECHNICAL STATUTORY ADVICE

A considerable contribution was made during the year to providing technical advice on stock remedies and, to a lesser extent, farm feeds to the Registrar of Act 36 of 1947, the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act. The work assumed such large proportions that as from next year a separate financial responsibility, the Section of Technical Statutory Advice, will operate.

A total of 230 applications for the registration of stock remedies were handled by experts of the Institute. Forty-eight of those handled were new registrations and 107 re-registrations. Approximately 500 advertisements were checked for scientific accuracy before they were passed on to the press.

DIVISION OF VETERINARY SERVICES

VETERINARY RESEARCH

Miscellaneous research projects

Officers of the Regional veterinary laboratories, the AI and Reproduction Section and the Poultry Diagnostic Section continued with research work on various projects.

The AI and Reproduction Section was engaged in a multidisciplinary investigation into the causes of poor financial returns realised by fresh milk producers.

The Poultry Diagnostic and Extension Services Section attempted the artificial transmission of *spirochaetosis* in order to obtain repeatable continuous transmission for a comparative effectivity study on certain drugs against avian spirochaetosis. All attempts at artificial transmission failed. A *reovirus* suspected of causing tenosynovitis and viral arthritis was isolated. Research on *dikkop*, which is a widely distributed problem, is continuing. Work is also continuing on the standardisation and repeatability of a haemagglutination inhibition (HI) test which will provide a quantitative serological test to

supplement the existing extensive use of the agglutination plate test for *mycoplasmosis*.

In collaboration with scientists at Onderstepoort, officers of the Regional veterinary laboratory at Stellenbosch used an experimental vaccine against *Taenia multiceps* in sheep. Results are most encouraging.

The Regional veterinary laboratory at Middelburg (CP) conducted the following investigations:

Extensive outbreaks of *abortion* in Merino ewes were investigated. A *Bacillus* spp was almost constantly isolated from foetal material. One out of three pregnant rabbits exposed to infection with this organism aborted, but 3 groups of pregnant ewes exposed to the infection lambled normally.

Experiments to determine the toxicity of *Tribulus terrestris* for rabbits, guinea pigs and mice were undertaken to find a more economical experimental animal. These experiments yielded negative results.

Specimens of plants growing on various soil types have been collected and analysed for trace elements to establish the role played by soil composition with regard to the mineral and notably copper content of the plant in causing *enzootic icterus*. Experiments were also carried out to determine the optimal dose regimen and a practical means of administering *zinc sulphate* as a preventive measure.

An experiment involving 64 Angora goats was carried out to establish the role played by *Ostertagia circumcincta* in causing *swelsiekte*.

Following on the initial success in reproducing *dronksiekte* in a calf by feeding *Melica decumbens*, further feeding trials in cattle and sheep were carried out. These experiments have yielded negative results.

A disease known as *klontgal*, which is characterised by severe chronic liver damage, ascites and the occurrence of extensive clots of bile in the bile ducts was also investigated. At this stage the plant *Hertia pallens* is strongly suspected as a possible cause.

Studies on the various aspects of *alopecia* in goats are still in progress.

The problem of *cleft palates* in Angora goats was also investigated. Plant surveys have been conducted to follow up the possibility of teratogenicity in some of these plants.

Attention was paid to the development of methods for extracting the pigments in *olive green discoloured sheep carcasses* encountered at the Port Elizabeth Abattoir.

Investigations were also initiated into the problem of *ophthalmia* in small stock. *Neisseria sicca* was very often isolated from cases of *ophthalmia*.

In collaboration with the Veterinary Research Institute at Onderstepoort further investigations were carried out into the condition known as *necrotic balanitis*. In addition to *Fusobacterium necrophorum*, three different mycoplasmas were isolated.

VACCINE SALES

Vaccine	Doses issued		
	1978/79	1979/80	1980/81
<i>Bacterial vaccines</i>			
Enterotoxaemia (oil): (<i>Cl. perfringens</i> D)	9 992 900	9 895 400	8 344 000
Enterotoxaemia (alum): (<i>Cl. perfringens</i> D)	30 105 400	31 291 600	41 041 450
Enterotoxaemia (total)	40 098 300	41 187 000	49 385 450
Lamb dysentery: (<i>Cl. perfringens</i> B)	246 500	186 950	165 600
<i>Brucella</i> S19 (cattle):	2 298 206	1 923 002	2 994 458
<i>Brucella</i> Rev 1 (sheep):	553 015	641 920	567 020
<i>Corynebacterium ovis</i>	133 010	236 040	162 082
<i>Corynebacterium pyogenes</i>	555 320	662 000	704 640
Swelled head in rams: (<i>Cl. novyi</i>)	150 450	113 850	116 800
Colibacillosis (cattle and sheep) (<i>E. coli</i>)	74 810	85 560	103 370
Colibacillosis (pigs): (<i>E. coli</i>)	244 060	270 650	272 220
Fowl typhoid: (<i>S. gallinarum</i>)	2 004 800	2 295 700	3 092 400
Botulism: (<i>Cl. botulinum</i> C & D)	5 110 715	7 219 875	5 453 300
<i>Clostridium septicum</i>	163 020	117 880	141 620
Bovine pleuropneumonia: (<i>M. mycoides</i>)	580 800	665 800	475 000
Anthrax: (<i>B. anthracis</i>)	14 415 030	16 421 950	23 445 370
Paratyphoid (live): (<i>Salmonella dublin</i>)	302 534	329 592	428 474
Paratyphoid (inactivated): tri-valent	14 994	56 710	102 404
<i>Pasteurella</i> (sheep)	2 730 500	3 054 180	2 522 150
<i>Pasteurella</i> (cattle)	-	-	3 142 240
Black-quarter (quarter-evil): (<i>Cl. chauvoei</i>)	7 973 682	7 220 036	8 856 292
Tetanus: (<i>Cl. tetani</i>)	159 320	174 080	246 950
<i>Vibrio fetus</i>	129 000	196 200	174 550
<i>Haemophilus coryza</i> : <i>Haemophilus</i> -verkoue: (<i>H. gallinarum</i>)	4 433 300	5 404 800	3 837 900
Combined black-quarter/botulism:	1 963 468	1 742 934	3 523 456
Erysipelas (pigs)	-	7 720	27 240
	84 334 834	90 213 429	109 968 286
<i>Virus vaccines</i>			
Enzootic abortion: (<i>Chlamydia</i>)	3 032 700	3 141 300	3 622 700
Bluetongue	25 290 400	23 623 000	21 009 400
Pigeon pox	685 300	462 700	428 300
Fowl pox	3 595 000	2 925 200	2 486 000
Distemper	52 547	56 657	65 486
Rabies	296 046	484 538	1 683 811
Infectious bronchitis (poultry)	8 971 000	7 262 000	3 149 000
Infectious laryngotracheitis	9 858 000	10 357 000	16 310 000
Lumpy skin	1 544 610	1 307 530	1 387 697
Newcastle disease (Komarov)	12 037 500	14 267 500	17 566 500
Horsesickness	187 531	180 815	187 852
IBR (Infectious bovine rhinotracheitis) (live)	120 740	148 530	283 280
IBR: (inactivated)	-	1 700	4 040
Rift Valley fever (live-sheep)	1 147 000	843 900	525 100
Rift Valley fever (inactivated-cattle)	1 386 000	1 867 350	1 233 250
Wesselsbron disease	798 200	26 400	408 800
Emphemeral fever (three day stiffness)	51 790	117 356	157 815
Total for virus vaccines	69 054 464	67 073 476	69 509 031
<i>Protozoal and rickettsial vaccines</i>			
Anaplasmosis (gallsickness)	496 530	432 047	448 126
Heartwater blood	122 310	117 692	203 610
Redwater	124 145	125 357	146 790
Elephant skin disease (<i>Besnoitia</i>)	71 570	82 315	143 969
Total for protozoal and rickettsial vaccines	814 555	757 411	942 495
Grand total for all vaccines (doses)	170 836 850	158 044 316	180 419 812
<i>Diagnostic aids (Antigens-in ml)</i>			
BWD-antigen (<i>Salmonella gallinarum/pullorum</i>)	26 910	14 670	15 350
<i>Brucella abortus</i> SAT antigen	36 000	20 100	13 000
<i>Brucella</i> milk ring test antigen	1 280	1 500	1 200
<i>Brucella</i> Rose Bengal antigen	7 300	8 240	10 860
<i>Brucella</i> CF antigen	0	2 780	6 540
Tuberculin (bovine)	152 382	145 914	147 084
Tuberculin (avian)	109 250	50 270	60 522
<i>Mycoplasma gallisepticum</i> (CRD) antigen	2 980	2 110	3 350
Dourine antigen	-	-	390
Total for Diagnostic Antigens (ml)	339 107	245 584	267 256
<i>Antisera (in ml)</i>			
Tetanus (<i>Cl. tetani</i>)	-	470	1 370
Botulism (<i>Cl. botulinum</i>)	-	890	1 890
<i>Brucella abortus</i> standard positive serum	-	27	68
Total for antisera (ml)	-	1 387	3 328

VACCINES AND ANIMAL REMEDIES

The following vaccines were produced by State Veterinarians, veterinary laboratories and/or regional veterinary laboratories:

Heartwater	27 034 ml
Autogenous wart	12 210 ml
Contagious pustular dermatitis (orf)	12 915 ml

The following laboratory products were produced for own use by the laboratories mentioned below.

Regional veterinary laboratory - Stellenbosch

<i>Leptospira</i> antigen	1 360 ml
Media	238 550 ml
Reagents	120 ml

Regional veterinary laboratory, Middelburg (CP) and veterinary laboratories at Grahamstown and Queenstown

Solid media	627 169 ml
Fluid media	234 285 ml
Reagents and stains	378 578 ml

During the year 1 300 doses of supplementary bluetongue vaccine and 100 000 doses of infectious bronchitis oral vaccine were destroyed. The total value was R163. These vaccines were destroyed because the expiry date of the vaccine had been reached or the manufacturer's directions for storage had not been complied with.

CONTROL OF ANIMAL DISEASES

NOTIFIABLE DISEASES

Foot-and-mouth disease

The infection in the Giyani district of Gazankulu, mentioned in the previous report, spread to two more dipping tank areas. This meant that a total of 30 dipping tank areas became infected.

The clinical end point was reached on 15 June 1980, and this campaign was concluded on 31 August 1980. During the campaign 200 635 cattle were vaccinated. Two oxen and one goat were destroyed to prevent the spread of the disease. The total number of cattle involved in this outbreak was 53 631.

In the previous report mention was also made of the 4 infected dipping tank areas in the Bolobedu district of Lebowa. The infection was confined to these 4 dipping tank areas and the clinical end point was reached on 2 February 1980. In all 4 583 cattle were involved.

On 21 July 1980 the dipping tank area of Matiana in the Malamulele district of Gazankulu

was found to be infected. The virus responsible was typed as SAT I. The infection spread to an adjoining dipping tank area but was then contained and the clinical end point was reached on 25 August 1980. A total of 3 351 cattle were involved and one ox was destroyed to prevent the disease from spreading; 70 081 cattle were vaccinated.

As from 25 August 1980 the Republic of South Africa was again free of foot-and-mouth infection.

The usual control measures were implemented in all the outbreaks. These measures involve a total embargo on the movement of cloven-hoofed animals or their products, the isolation of the infected area by means of cordons, and the vaccination of all animals on infected farms and also of susceptible animals on adjoining farms.

A double security fence was also erected on the southern bank of the Limpopo river by the SADF. This fence, if kept in good repair, will minimise the risk of foot-and-mouth disease entering the Republic of South Africa from Zimbabwe.

One outbreak of foot-and-mouth disease was diagnosed in impala in the Kruger National Park. During the culling operation in the Kruger National Park 158 buffalo carcasses were condemned owing to suspected foot-and-mouth lesions.

During the year under review, the following animals were illegally introduced into the Republic of South Africa from Botswana:

2 cattle valued at R25 each - slaughtered under supervision and R50 paid into Revenue.

77 cattle - slaughtered at an abattoir - carcasses realised R24 447,45. Full amount paid to owner, who was found not guilty.

57 cattle - slaughtered at an abattoir - carcasses realised R9 469,85 - paid into Revenue.

59 cattle - slaughtered at an abattoir - carcasses realised R22 651,62 - paid into Revenue.

27 cattle - slaughtered at an abattoir - carcasses realised R5 973,47 - court case pending.

17 goats - valued at R357 (R21 each) destroyed. Recommended that compensation be paid to owner.

Rabies

Of the 2 645 specimens submitted to the Veterinary Research Institute by officers of the Division of Veterinary Services, 472 (17,8 %) were positive for rabies. The large number of specimens submitted for diagnosis can be attributed to the publicity given to the epidemic in Natal. In the previous year 788 specimens were submitted, 31,9 % of which were positive.

The incidence of the disease among the various animal species was:

Meercat	155
Jackal	19
Dog	129
Cattle	87
Badger	4
Domestic cat	15

Skunk	7
Sheep	3
Species of wild cat	12
Steenbuck	1
Duiker	2
Kudu	1
Bat-eared fox	25
Guinea pig	1
Bat	10
Horse	1
472	

The outbreaks of rabies mentioned in the previous report continued, reaching epidemic proportions in and around the coastal towns of Natal. Outbreaks reached a peak in August/September 1980. Two humans died of rabies in KwaZulu and numerous people had to be treated.

A massive inoculation campaign for dogs was started and the epidemic was brought under control under the latter part of 1980.

In the other regions the incidence was more or less normal. There were 122 positive cases in the Highveld Region where yellow mongoose and cattle were primarily affected. In order to exterminate the mongooses in this region 3 780 Phostoxin tablets were used on 8 farms covering an area of 540 hectares.

In the Transvaal Region rabies occurred mainly in yellow mongooses and cattle. Large-scale poisoning of yellow mongooses with Phostoxin was undertaken. Some 400 colonies were treated with 12 670 Phostoxin tablets. Jackal eradication was implemented by individual farmers in the Rustenburg district.

In the Western Cape and Eastern Cape and Karoo Regions the infection was diagnosed mainly in bat-eared foxes.

In the Northern and Eastern Transvaal Region, 28 020 head of cattle were vaccinated against rabies. The jackal seems to be the main carrier of the disease.

Positive cases in KwaZulu amounted to 57 and included 53 dogs and 2 humans.

Lebowa reported 3 positive cases and Gazankulu 6 positive cases, which included one human. A total of 111 jackals were destroyed in Lebowa.

In all 429 822 dogs and 51 290 cats were immunised by officers of the Division of Veterinary Services. In the national states 341 582 dogs and 36 975 cats were inoculated.

Anthrax

Four outbreaks were recorded during the year under review.

One outbreak occurred in the Western Cape Region, where 8 head of cattle died from the disease.

In the Free State Region 3 outbreaks were recorded; 2 cattle died in the farming areas and 1 hartebeest in the Kalahari Gemsbuck Park.

There were numerous fatalities among bovines following the use of a faulty batch of vaccine. The relevant batch of vaccine was immediately withdrawn from the market.

As a preventive measure and during outbreaks, officers of the Division of Veterinary Services inoculated 2 869 042 cattle, 329 sheep, 46 goats, 34 equines and 13 pigs. Farmers inoculated 172 883 head of cattle.

In the national states 808 569 cattle were immunised as a preventive measure.

East Coast Fever and related diseases

East Coast Fever (*Theileria parva*)

No outbreaks were reported. In the Natal Region 3 136 spleen smears were examined, with negative results.

Compulsory spleen smear examination is still carried out in KwaZulu. A total of 154 834 spleen smears were examined, with negative results.

Corridor disease (*T. lawrencei*)

Eight outbreaks were confirmed in the Northern and Eastern Transvaal Region. A total of 115 cattle died of the disease. In the Lydenburg State veterinary area a buffalo which roamed the farming area for nearly twelve months caused the death of 70 cattle.

One outbreak was also reported from Gazankulu; it was caused by a herd of 9 buffalo that had been roaming about in the area. A total of 32 cattle died before the disease was brought under control by destruction of the buffalo and twice weekly dipping of all the cattle in the area.

Benign bovine Theileriosis (*T. mutans*)

Following the serological survey among cattle undertaken in the Messina district the previous year, *Rhipicephalus appendiculatus* ticks were collected in that area and forwarded to the Veterinary Research Institute at Onderstepoort for further study.

Other Theileriosis

At the Rietondale Experimental Farm in the Transvaal Region 16 cattle became ill and 8 died. Smears showed a heavy infection with a *Theileria* sp. which was later identified as *T. taurotragi*, an apparently harmless parasite.

In the Potchefstroom district of the Highveld Region 4 cattle died after showing symptoms of blindness and walking in circles. Smears from a brain embolus and lymph nodes were positive for *Theileria*, which was later identified as *T. taurotragi*. All the cattle were heavily infested with *Rhipicephalus appendiculatus*.

Tuberculosis

(Figures for the previous year are given in brackets).

Good progress was maintained with the

eradication of bovine tuberculosis. In all 5016 (4 374) certificates were issued to tuberculosis-free herds and 7 540 (6 785) herds participated in the eradication scheme. Positive reactors slaughtered amounted to 2 257 (2 527). Owners of these cattle received R636 077 (R515 958) in compensation. Carcases not condemned as being unfit for human consumption were sold for R472 581 (R309 216) and the moneys paid into Miscellaneous Revenue.

An amount of R620 220 (R540 987) was paid out under the Scheme to the 439 (415) contracted private veterinarians for services rendered on behalf of the State.

The total outlay of the scheme for this financial year was R2 114 234 (R1 700 059).

Since the initiation of the scheme 1 024 (926) previously infected herds have now qualified for tuberculosis-free certificates. An additional 3 herds have been treated with INH, bringing the total of herds treated since the inception of the scheme to 82.

According to tests, the incidence of bovine tuberculosis is still 2,9 %.

A total of 3 798 (2 744) herds, with 527 138 (384 303) head of cattle, which did not qualify for the accreditation scheme were tested under the diagnostic herd scheme.

A summary of all tuberculin tests carried out during the year is given in Table 1.

The incidence of tuberculosis in pigs remained high in the Transvaal Region. It must, however, be borne in mind that in practically all cases investigated *M. intracellulare* was diagnosed. From limited investigations conducted so far it would appear that infection is generally contracted from sawdust used for bedding.

TABLE 1 - Tuberculin tests carried out during 1980/81

Test	No. of herd tests	No. of tuberculin tests	Reactions	
			Positive	Suspected
Accreditation	6 845	916 616	-	581
Diagnostic herd	1 781	173 073	-	92
Infected	644	136 660	1 870	524
INH	32	9 402	313	90
Export	69	5 937	-	-
Import	28	44	-	-
Diagnostic	291	21 014	-	138
Total	9 690	1 262 746	2 183	1 425

In KwaZulu 133 cattle belonging to one herd were tested, with negative results.

The Chief Veterinarian of Gazankulu tested 4 herds with 509 cattle and found 6 suspicious reactors. In Lebowa only 1 herd with 110 cattle was tested and 1 animal gave a positive reaction.

Bovine brucellosis (*Brucella abortus*)

In accordance with the brucellosis eradication scheme a total of 383 577 heifers between the ages of 3 and 11 months were inoculated either by or

under the supervision of officers of the Division. Owners themselves inoculated a further 39 056.

A total of 46 353 heifers were vaccinated in the national states.

In infected herds 1 549 cows were vaccinated under official supervision, after written permission had been obtained from the local State Veterinarian.

The voluntary accreditation scheme has shown steady progress and 1 012 herds with a total of 98 483 cattle have joined the scheme. In all 278 brucellosis-free certificates have been issued.

The diagnostic scheme also showed steady progress in that 2 782 herds comprising 150 458 head of cattle were tested during the year. Of this number, 855 herds (30,7 %) and 5 734 cattle (3,7 %) were positive. *Brucella abortus* was confirmed in 50 cases of abortion investigated. In the Kruger National Park 22,8 % of the 428 buffalo blood samples tested were positive for brucellosis.

A summary of tests carried out is given in Table 2.

TABLE 2 - Tests for bovine brucellosis

Type of test	No. of tests	
Rose-Bengal	318 101	
Complement fixation	146 990	
Tube agglutination	46 049	
Milk tests		
Type of test	No. of tests	No. positive
Milk ring test	3 086	312
Bacteriological/biological	47	4

Trypanosomiasis

Nagana

Following the diagnosis of a single case of nagana in the Natal Region, which was mentioned in the previous report, surveys were undertaken on farms bordering on the area known to be infected with tsetse fly. Blood smears from 10 cattle each on three farms were examined during the first survey. Of the 30 blood smears examined 6 smears on two farms were positive for *T. vivax* and 3 for *T. congolense*. On the third farm only one smear was positive for a *Trypanosoma* sp. In the second survey on 22 farms in the same area cattle on only 5 farms were found to be infected.

It must, however, be emphasised that no outbreaks of Nagana occurred and provided that cattle are kept out of the known fly belts there is very little likelihood of their becoming infected.

The so-called fly belts are strips of dense bush on the banks of the Mkuze River and Lake St Lucia.

Dourine

Of the 2 964 blood samples tested by the Veterinary Research Institute and Regional veterinary laboratories, 32 (1,07 %) were positive.

Stallions which showed a positive reaction were either castrated or slaughtered and mares sterilised or slaughtered. No compensation was paid to the owners since all the tests were carried out at the owners' request.

Lumpy skin disease

No cases were reported in the Eastern Cape and Karoo Region and only a few in the Western Cape.

In the Natal Region 11 outbreaks were reported, in the Transvaal 17, in the Northern and Eastern Transvaal 28, in the Highveld 7 and in the Free State 23. Practically all outbreaks were caused by the Allerton strain of the virus. Officers of the Division of Veterinary Services assisted farmers with the inoculation of 135 734 cattle.

A severe outbreak occurred in one district of KwaZulu and only sporadic cases were observed in Gazankulu. No outbreaks were reported in Lebowa.

Sheep scab

The compulsory dipping campaign for 1980/81 was extended to cover a period of six months. The dipping commenced on the first of September 1980 and was supposed to end on 28 February 1981. However, problems were encountered in some regions and dipping had to be continued until after the end of February 1981.

By 28 February 1981, 30 821 442 sheep had been dipped, which is 57 076 less than the number dipped during the previous campaign.

Preliminary expenditure up to the end of March 1981 amounted to R1 007 588,49.

The number of outbreaks decreased from 280 in the previous year to 235 during the year under review. This must be attributed to the success of the compulsory dipping campaign. It should also be borne in mind that the previous report only covered a period of 9 months. Of the 235 outbreaks, 107 occurred in White areas and 128 in the national states.

The magisterial districts in which infection occurred, together with the number of outbreaks in each, are as follows:

Hewu 16, Umtata 14, Jacobsdal 10, Nkandla 10, Johannesburg 8, Idutywa 8, Nqutu 8, Queenstown 7, Glen Grey 7, Qumbu 6, Bizana 6, Pretoria 6, Standerton 5, Mt Fletcher 5, Engcobo 5, Aliwal North 4, Carnarvon 4, Maclear 4, Bloemfontein 4, Libode 4, Herschel 3, Mt Frere 3, Elliotdale 3, Clocolan 3, Excelsior 3, Rouxville 3, Elliot 3, Uitenhage 3, Cofimvaba 2, Matatiele 2, Tsolo 2, Flagstaff 2, Nongoma 2, Hlabisa 2, Ingwavuma 2, Utrecht 2, Fauresmith 2, Smithfield 2, Bothaville 2, Kroonstad 2, Lichtenburg 2, Sasolburg 2, Ventersburg 2, Cathcart 2, Graaff-Reinet 2, Lady Grey 2, Nqamakwe 1, Lusikisiki 1, Tsomo 1, Kentane 1, Tabankulu 1, Willowvale 1, Xalanga 1, Umzimkulu 1, Nqamduli 1, Ngqeleni 1, St Marks 1, Selasesha 1, Umbumbulu 1, Mahlabatini 1, Seshego 1,

Thabamopo 1, Ixopo 1, Richmond 1, Underberg 1, Laingsburg 1, Malmesbury 1, Bethulie 1, Boshof 1, Kenhardt 1, Koffiefontein 1, Warrenton 1, Bultfontein 1, Heilbron 1, Ventersdorp 1, Wolmaransstad 1, Burgersdorp 1, Sterkstroom 1, Stockenström 1 en Piet Retief 1.

Thirty-seven magisterial districts in the national States and 43 in the White areas were found to be infected.

A total of 457 706 sheep were dipped on infected and contact farms. All these sheep were dipped at least twice, at an interval of 8 to 10 days, under official supervision.

All the sheep in the national States were also dipped except for sheep in KwaZulu, where only a percentage of the national flock was dipped.

Mange

One outbreak of goat mange involving 147 goats occurred in the Natal Region. In KaNgwane 3 outbreaks of goat mange were reported and isolated outbreaks occurred throughout KwaZulu.

Equine mange involving 3 horses was diagnosed in the Transvaal Region.

Sporadic cases of cattle and pig mange were observed in all the Regions. In the Kruger National Park mange was observed in lions, giraffe and gnu.

Demodectic mange is common in buffalo.

African swine fever

No outbreaks were recorded. There are 446 approved piggeries with 42 064 pigs in the White area and 6 approved piggeries with 829 pigs in Lebowa.

Swine erysipelas

This disease is prevalent in the Natal and Western Cape Regions, but normally only occurs when pigs are subjected to stress. This usually occurs when consignments are transported to abattoirs for slaughter. Five outbreaks were recorded in the Natal Region, 3 in the Eastern Cape and Karoo Region and 7 in the Transvaal Region.

Epizootic lymphangitis

No cases were reported.

Johne's disease

Four cases of Johne's disease were reported - one each in the Transvaal, Highveld, Free State and Western Cape Regions.

Infectious laryngotracheitis

One outbreak was confirmed amongst turkeys in the Eastern Cape and Karoo Region.

In the Western Cape Region there has been an increase in the incidence in both broilers and laying hens.

Rinderpest

This disease does not occur in the Republic.

Newcastle disease

Owing to the large-scale use of vaccine by the poultry industry there were very few outbreaks.

In the Natal Region 5 outbreaks were recorded involving 491 fowls. Confirmed outbreaks occurred on three farms in the Bethlehem district of the Highveld Region. The fowls belonged to farm labourers and the mortality rate was between 50 % and 80 %.

Two outbreaks were diagnosed in the Transvaal Region; a total of 550 birds were involved only 12 of which died.

Trials undertaken in the Western Cape Region with the imported cloned La Sota vaccine seem to indicate that this vaccine is not an improvement on the standard La Sota vaccine and is much more expensive.

Bacillary white diarrhoea (BWD) and fowl typhoid

Four outbreaks involving small poultry flocks were recorded in the Transvaal Region.

Fowl cholera

A single outbreak occurred during the year on a turkey farm in the Natal Region. Losses were heavy and although the outbreak was initially controlled by the administration of antibiotics it was finally eliminated with the aid of vaccine.

Psittacosis

Two outbreaks were recorded in the Pretoria district of the Transvaal Region. A total of 279 racing pigeons were involved, 8 of which were affected. In both outbreaks children living on the premises had contracted colds or slight cases of pneumonia.

The premises were quarantined and the outbreaks were brought under control by disinfection and the use of antibiotics.

In the Western Cape Region the disease was diagnosed in a human who had close contact with two cockatiels. Both birds were destroyed and one was found to be positive.

Scrapie

No cases were reported.

Equine infectious anaemia

This disease does not occur in the Republic.

Glanders

No cases have been reported since 1945.

Contagious bovine pleuropneumonia

No cases have been reported in the Republic since 1924.

NON-NOTIFIABLE DISEASES

Bacterial diseases

Mastitis

The mastitis control scheme initiated by staff of the Regional veterinary laboratory at Allerton in the Natal Region continues to make good progress and has attracted interest from other Regions. A further 36 herds joined the scheme, which brings the total number of participating herds to 145. The number of cows in the scheme similarly increased by 3 754 to 15 314. The incidence involving *Staphylococcus aureus* as the main pathogen has been reduced from 72,8 % the previous year to 60,18 % this year.

The number of somatic cell counts undertaken during the year under review was 18 094, compared to 15 786 the previous year.

In the Natal Region 411 outbreaks of mastitis involving 2 079 cows were reported.

In the Highveld Region 15 369 milk samples were examined by the two veterinary laboratories.

In the Western Cape and Eastern Cape and Karoo Regions it was established that mastitis in ewes was caused mainly by *Pasteurella haemolytica*.

Enterotoxaemia (Pulpy kidney)

Sporadic cases occurred throughout the country. In the Natal Region, 11 outbreaks involving 40 sheep were recorded.

Officials of the Division of Veterinary Services assisted 55 farmers in the Highveld Region in inoculating 4 918 sheep.

Black quarter

Except for the Western Cape, where no cases were recorded, the disease was rife throughout all the other regions.

Mortality among cattle, sheep and goats as recorded by State Veterinarians in the different regions was as follows:

Northern and Eastern	138 cattle, 39 sheep and
Transvaal Region	6 goats
Transvaal Region	215 cattle
Highveld Region	112 cattle and 41 sheep
Natal Region	1 275 cattle and 71 sheep

On three farms in the Rustenburg State veterinary area abortions among cattle were caused by *Clostridium oedematiens*. The organism was isolated in pure culture from the uteri.

Officials of the Division of Veterinary Services assisted farmers in inoculating 38 343 cattle.

In Gazankulu 60 823 cattle were vaccinated and in Lebowa 203 926 cattle and 201 sheep.

Botulism

Sporadic cases occurred throughout the country, especially in the drought-stricken areas. In the Calvinia State veterinary area 1 045 sheep, 36

cattle and 1 horse died of the disease.

Nine outbreaks with 35 cattle deaths were recorded in the Transvaal Region.

Only two outbreaks with 21 cattle deaths occurred in the Highveld Region.

Ostrich bones were the cause of death of 8 cows in the Eastern Cape and Karoo Region.

In the Northern and Eastern Transvaal, 22 deaths were recorded in cattle and in the Free State Region, 200 sheep and 2 horses died of the disease.

A total of 120 792 cattle were vaccinated by officers of the Division of Veterinary Services.

In Lebowa 54 970 cattle were vaccinated.

Corynebacteriosis

As in the past this disease was widespread throughout the Republic in both cattle and small stock.

At the Cato Ridge abattoir alone it resulted in the condemnation of 2 821 sheep and goat carcasses.

In the Western Cape, Free State and Eastern Cape and Karoo Regions infection with this organism in sheep and goats manifested itself as subcutaneous abscesses, abscesses in the liver, brain and spinal cord, purulent arthritis and omphalophlebitis.

The organism was also isolated from aborted bovine foetuses in the Transvaal Region. In the Rustenburg State veterinary area 70 sheep fed intensively developed abscesses of the head and jaw and eventually died of starvation.

Lung abscesses caused the death of 95 cattle in the Highveld Region.

Pasteurellosis

This disease has undoubtedly become one of the more important bacterial diseases in the Republic of South Africa.

It was responsible for the deaths (reported) of 47 cattle, 52 sheep and 201 goats in the Natal Region. In the Highveld Region 98 sheep, 26 goats and 70 cattle succumbed to the disease. Mortality in the Transvaal Region was recorded among sheep and cattle. In the Rustenburg State veterinary area 50 cattle and 25 sheep died and in the Pretoria State veterinary area the mortality figures were 51 cattle and 128 sheep.

A survey undertaken at one of the abattoirs in the Western Cape Region showed that out of a total of 16 008 rejected pig lungs 3 772 (23,6 %) were affected.

Tetanus

As in the past a few cases were reported and in practically every instance the disease was caused by the use of the elastrator rubber ring.

In the Natal Region 3 deaths were recorded, 2 of bovines and one of a horse.

A major outbreak was encountered in the Rustenburg State veterinary area, where 90 lambs died of the disease.

In the Western Cape Region 246 lambs died in the Calvinia district, 96 in the Bredasdorp district and 11 in the Malmesbury district.

Colibacillosis

Sporadic cases among calves and piglets were recorded throughout the country.

In most instances poor housing and management were responsible for the spread of the disease. Where good management was practised and use was made of the vaccine very few problems due to this disease were encountered. In the Free State Region two outbreaks were investigated. In the one instance the farmer lost 25 piglets and in the other outbreak 3 entire litters were lost. Seven angora kids and 6 calves succumbed to the disease in the Northern and Eastern Transvaal Region.

In the Highveld Region 32 calves were treated in the Potchefstroom State veterinary area and 9 died in the Bethlehem State veterinary area.

Leptospirosis

It was mentioned in the previous report that an experimental vaccine had been used on 8 farms in the Western Cape Region where the disease was endemic. During this year no further problems were encountered and only 2 pigs slaughtered showed kidney lesions.

Reproduction problems and abortions were encountered in cattle and pigs in the Northern and Eastern Transvaal Region.

Three more outbreaks occurred this year among cattle in the Highveld Region. On one farm 20 out of 340 cows aborted. Use of the experimental vaccine proved very successful.

Pseudomonas infection

The organism was isolated from milk samples, sheath washings of rams, and occasionally from wool which showed a green discoloration.

Actinobacillosis and actinomycosis

A few cases of these diseases were diagnosed in the Western Cape Region (five cases diagnosed in the Calvinia State veterinary area), Free State (one case), Highveld (two cases), Eastern Cape and Karoo (one case) and Northern and Eastern Transvaal (among impala in the Kruger National Park) Regions.

Foot-rot and foot abscess

The incidence of foot abscesses among sheep in the different regions varied according to prevailing climatic conditions.

In the Free State Region up to 75 % of sheep in some flocks were affected.

Sporadic cases of foot-rot among cattle occurred throughout the country.

Strangles

Only five cases were diagnosed in the Eastern

Cape and Karoo Region.

Lamb dysentery

No cases were confirmed.

Listeriosis

In the Eastern Cape and Karoo Region a *Listeria* organism was isolated from a faecal swab originating from a sick parrot.

Red gut

Mortality was drastically reduced in the Western Cape Region, mainly as a result of the dry autumn and winter seasons.

A single outbreak among goat kids occurred in the Kuruman State veterinary area and in the Pretoria State veterinary area the disease was diagnosed in 2 sheep and 2 goats fed intensively on lucerne.

Protozoal diseases

Babesiosis

Redwater was prevalent in all the Regions. The disease remains one of the most important diseases of cattle, horses and dogs in the Natal Region, where 961 outbreaks involving 3 087 cattle were recorded. Most cases occur from February to June.

Isolated cases occurred in the Western Cape Region, with the Mossel Bay State veterinary area showing a slightly higher mortality rate than other areas.

In the Transvaal Region 144 outbreaks in which 695 cattle died were caused mainly by *Babesia bovis*.

Sporadic cases were encountered throughout the Highveld Region with fourteen recorded outbreaks in the Klerksdorp district and 10 in the Potchefstroom district.

In the Free State and the Eastern Cape and Karoo Regions sporadic cases were encountered. In the latter region the disease seems to be spreading further inland.

Of the 27 outbreaks recorded in the Northern and Eastern Transvaal Region only 9 were caused by *Babesia bovis*. This parasite plays a more important part in the Lydenburg and Nelspruit State veterinary areas than in the other parts of the Northern and Eastern Transvaal Region.

In Lebowa 370 cattle were treated for babesiosis. As a result of more effective dipping babesiosis was not a problem in KwaZulu.

Anaplasmosis (Gallsickness)

Cases were diagnosed in many parts of the country.

In the Natal Region 446 outbreaks involving 1 014 cattle were recorded.

Anaplasmosis is the commonest tick-borne disease in the Highveld Region, where 86 outbreaks were recorded during the year under review.

Although anaplasmosis is not a serious problem in the Transvaal Region (41 outbreaks with 65 deaths), there was an increase in the number of per-acute cases. Blood smears in such cases have generally shown a massive parasitaemia.

Sporadic outbreaks also occurred in the Free State (13 outbreaks), Eastern Cape and Karoo and Northern and Eastern Transvaal (3 outbreaks) Regions.

Besnoitiosis (Elephant skin disease)

The fairly general use of the vaccine in past years has resulted in a markedly reduced incidence of this disease.

Seventeen bulls were culled in the Northern and Eastern Transvaal Region and 157 cattle on 45 farms in the Ellisras State veterinary area were found to be infected.

Only 9 cases were reported in the Transvaal Region and 6 in the Highveld Region.

In the Free State Region 2 cases were reported.

Officials of the Division of Veterinary Services vaccinated a total of 11 545 head of cattle.

Coccidiosis

Cases of coccidiosis occurred among calves and lambs throughout the country, especially where the animals were kept in feedlots or on established pastures.

Ten outbreaks among calves were reported in the Transvaal Region and 3 outbreaks involving 14 calves in the Northern and Eastern Transvaal Region.

In the Free State Region 5 outbreaks were reported, 3 in calves, one in goats and one in chickens.

Of the 1 054 post-mortems performed on poultry by the Veterinary Laboratory in Kroonstad, 169 were positive for coccidiosis.

Virus diseases

Bluetongue

The three phase vaccination programme has had a varied reception from farmers. Some have made no effort to vaccinate their sheep, others only did the initial vaccination, while others combined all three vials of vaccine as a single injection.

Numerous outbreaks were therefore recorded, especially in the Highveld and Free State Regions. It was estimated by the State Veterinarian, Bloemfontein, that at least 30 % of flocks in the Bloemfontein district were affected in varying degrees.

In the Natal Region only 33 outbreaks involving 215 sheep were recorded. Very few cases were recorded in the Transvaal Region.

Officers of the Division of Veterinary Services vaccinated 44 989 sheep in the Highveld Region.

No outbreaks of bluetongue were recorded in Lebowa, Gazankulu or KwaZulu.

African horsesickness

Extensive outbreaks occurred during March 1981 in the Transvaal Region. In the Rustenburg State veterinary area at least 50 horses died of the disease and in the Pretoria State veterinary area 18 known outbreaks were recorded. Private veterinarians in the Johannesburg district estimated that losses ran into hundreds.

Numerous outbreaks also occurred in the Free State Region, where 33 cases were reported and the Northern and Eastern Transvaal Region, where 46 cases were reported.

In the other regions only a few cases were reported.

Heartwater

The usual spate of losses occurred in the endemic areas.

In the Natal Region 315 outbreaks involving 860 cattle and 10 outbreaks involving 63 sheep and goats were reported.

A new strain, more virulent than the Ball 3 strain of *Cowdria ruminantium*, was discovered in the Northern and Eastern Transvaal Region. Losses reported by State veterinarians in this region amounted to 272 cattle, 170 goats and 258 sheep.

In the Transvaal Region 248 deaths were reported. The State Veterinarian at Vryburg reported 280 deaths in his area.

In the Western Cape Region the disease was recorded only in the Mossel Bay State veterinary area, where it occurred mainly among sheep introduced into the area.

In Lebowa 813 head of cattle, 347 sheep and 471 goats were treated for heartwater.

Ephemeral fever (Three-day stiffness)

Numerous cases were diagnosed in the Transvaal, Free State and Eastern Cape and Karoo Regions. The State Veterinarian at Standerton estimated that over 90 % of farms in his area were affected.

Sporadic cases also occurred in the Northern and Eastern Transvaal and Natal Regions (63 outbreaks involving 399 cattle) but no cases were observed in the Western Cape Region.

Sporadic cases were also encountered in the Highveld Region, and in the Bethlehem State veterinary area cases were encountered on practically every farm. Officials of the Highveld Region assisted farmers in vaccinating 9 909 head of cattle.

Morbidity as well as mortality was low.

Rift Valley fever and Wesselsbron disease

Odd cases of Rift Valley fever were diagnosed by private practitioners in the Highveld Region. The diagnosis was, however, not confirmed by the Veterinary Institute at Onderstepoort. Officials of the Highveld Region assisted farmers with the inoculation of 9 909 sheep.

Bovine malignant catarrh

Seven outbreaks of the disease involving 30 cattle occurred in the Transvaal (1 outbreak), Natal (4 outbreaks) and Northern and Eastern Transvaal (2 outbreaks) Regions. In all these outbreaks there had been contact with blue wildebeest.

Pulmonary adenomatosis (Jaagsiekte)

Outbreaks were recorded in all the Regions except the Northern and Eastern Transvaal Region.

Infectious ophthalmia

This disease occurred throughout the country.

In the Eastern Cape and Karoo Region up to 60 % of some flocks were affected.

In the Malmesbury State veterinary area 30 to 60 %, in the Swellendam State veterinary area 20 % and in the Mossel Bay State veterinary area 50 % of sheep flocks were affected.

Treatment with antibiotics does not produce satisfactory results.

Contagious pustular dermatitis (Vuilbek, orf)

Sporadic outbreaks occurred throughout the country.

Autogenous vaccines are prepared but in most cases the disease has already spread through most of the flock. It was, therefore, decided to import an orf vaccine and to use this vaccine prophylactically on farms where orf is known to occur. This experiment is still in progress and the results will probably be available next year.

Mucosal disease

A single outbreak occurred in the Estcourt district of the Natal Region. In order to control the disease, the whole group of steers in which it was present was sent to the abattoir for slaughter.

Infectious bovine rhinotracheitis

This disease again presented problems in feedlots and at the Irene bull testing station in the Transvaal Region.

At the Irene bull testing station 193 cases were diagnosed, only 3 of which required intensive treatment.

A single outbreak involving 5 cows occurred in the Free State Region.

Akabane virus

No outbreaks of Akabane virus infection were reported.

Feline infectious enteritis

Occurred throughout the country. Cats are treated for this disease by private practitioners.

Parvo virus

An epidemic of this disease swept through the whole country killing many hundreds of dogs.

The disease was brought under control through the use of imported vaccine. Vaccinations were done by private practitioners.

Enzootic bovine leucosis

Agar gel immunodiffusion tests performed on certain herds with imported cattle confirmed the suspicion that the disease is present in this country. A total of 119 cattle were found to be positive.

Fungal diseases

Ringworm

Infection in cattle, sheep and dogs was diagnosed throughout the country.

The incidence in Karakul flocks in the North-Western Cape was between 1 and 5 %.

At the Irene bull testing station 50 % of all the bulls were found to be infected.

Good results were obtained with the use of dichlorophen on cattle in the Highveld Region.

Lumpy wool

Outbreaks of lumpy wool were prevalent throughout the country. Mortality due to this condition was encountered in sheep in the Natal and Free State Regions. In the latter region 40 lambs succumbed to the infection.

Many cases occurred after dipping where the necessary precautions had not been taken.

Streptothricosis (Senkobo)

A single outbreak was diagnosed in the Rustenburg State veterinary area. Two cows were affected and as they were in very poor condition the State Veterinarian advised the owner that they should be destroyed.

Infertility and venereal diseases

Infertility problems and poor calf and lamb crops were reported from most of the regions.

The dry conditions which prevailed in certain parts of the country undoubtedly had an adverse effect on calf and lamb crops.

In the Namaqualand district where drought conditions prevailed throughout the year there was an estimated 50 % loss of the lamb crop. Problems were also encountered in the coastal area of Bredasdorp, where high concentrations of oestrogenic substances in the clover grazing caused poor lamb crops. An exceptionally high incidence of dystocia (20 %) was noted and lambs appeared to be stunted.

Owing to drought conditions and overstocking the calving percentage in KwaZulu fell to 32,6 %. In Gazankulu the calving percentage was estimated at between 30 and 40 %. This was mainly due to overstocking - 122 %.

In the Highveld Region 176 bulls from 29 herds were examined for fertility. Twenty-five bulls were found to be infertile. Of the 1 867 cows from 40 herds examined for pregnancy, 57 % were found to be in calf.

The veterinary laboratory at Kroonstad did a survey on uteri collected at abattoirs. Of the 501 uteri examined, 44 % were normal. With regard to the diseased material, it was interesting to note that the major causes of uterine pathology were post-putrefaction infection and anoestrus due to cystic ovaries.

In the Northern and Eastern Transvaal Region 7 928 cows from 88 herds were examined for pregnancy. The percentage found to be pregnant varied between 63 and 79 %. Of the 302 bulls examined 49 were culled.

Vibriosis

The disease was diagnosed in the Transvaal, Natal, Eastern Cape and Karoo and Highveld Regions. An examination of the sheath washings of 1 320 bulls showed that only 23 (1,7 %) were positive for vibriosis.

The regular use of the vaccine has undoubtedly played a major role in combating this disease.

Trigonomiasis

The disease was diagnosed in all the Regions with the exception of the Free State and Highveld Regions.

Of the 1 234 sheath washings examined, 52 (4,2 %) were positive for trichonomiasis. With no suitable vaccine available this disease is still of economic importance in many Regions.

Chlamydiosis

Sporadic cases of abortion in sheep and cattle were encountered in all the Regions.

In the Northern and Eastern Transvaal Region 23 aborted fetuses and 9 placental samples were examined and were all found to be negative for chlamydia.

Three outbreaks were recorded in the Western Cape Region.

One outbreak each was diagnosed in the Natal and Free State Regions. The State Veterinarian, Kimberley reports chronic forms of the disease in lambs, joint infections being the characteristic symptom.

Officials of the Highveld Region assisted farmers in vaccinating 286 sheep and 6 087 cattle.

Actinobacillus seminis

The Regional veterinary laboratory at Stellenbosch examined 2 173 semen samples from rams and of these 17 (0,8 %) were positive for *Actinobacillus seminis*.

The incidence of *Actinobacillus seminis* in semen samples examined by the Regional

veterinary laboratory at Middelburg (CP) was 13 %.

Of the 239 semen samples of rams examined by the veterinary laboratory at Kroonstad, 3 were positive for *A. seminis*. A total of 108 sheath washings of bulls were examined by the same laboratory and 3 specimens were found to be positive for actinobacillosis.

Brucella ovis

The Regional veterinary laboratory at Stellenbosch examined 2 173 semen smears and of these 31 (1,4 %) were positive for *Brucella ovis*.

The incidence of the disease in the Eastern Cape and Karoo Region appears to be 14 %, judging by smears examined at the Regional veterinary laboratory, Middelburg.

Of the 50 211 rams examined at the Veterinary laboratory, Bloemfontein, 11,7 % were found to be infected.

Only one of the 239 semen samples examined at the Kroonstad veterinary laboratory was positive. Farmers appear to attach too little importance to this disease considering the fact that very few flocks can be considered clean.

Infectious epididymitis/vaginitis ("Epivag")

Only one outbreak of the disease was diagnosed in the Highveld Region, 90 out of 110 cows were infected.

Posthitis and necrotic balanitis/vulvitis

The Regional veterinary laboratory at Middelburg (C P) investigated 6 outbreaks of posthitis in rams.

Q Fever (*Coxiella burnetti*)

This infection was confirmed as being the cause of two abortions in cattle in the Rustenburg State veterinary area. Abortions due to this organism were also diagnosed in Angora goats in the Mossel Bay State veterinary area.

Diseases of calves

White scours

Cases of this disease occurred throughout the country.

In the Highveld Region 32 calves were treated and 9 died of the disease.

The incidence has greatly diminished in the Western Cape Region owing to extension work by officers of the Division of Veterinary Services.

Paratyphoid

Paratyphoid in calves played a very important role in the Natal Region, where 183 outbreaks involving 575 calves were recorded.

Seventeen calves died in the Highveld Region and 32 in the Northern and Eastern Transvaal Region.

In the Transvaal Region 5 outbreaks involving 19 calves were recorded.

Sporadic outbreaks occurred in the Free State, Western Cape (4) and Eastern Cape and Karoo Regions. Losses were mainly due to poor hygiene and to the failure of farmers to make use of the vaccine.

Calf diphtheria

A single case was diagnosed in the Eastern Cape and Karoo Region.

Sweating sickness

Outbreaks occurred in the Transvaal (4), Northern and Eastern Transvaal and Free State (8) Regions.

Enteroviruses

No cases were reported.

Diseases of poultry

Management problems still remain one of the most important causes of poultry diseases, especially among the smaller organisations and the backyard farming community. Of these, problems associated with ventilation are probably the most important, followed by overcrowding, inadequate nutrition and hygiene.

The Poultry Diagnostic and Extension Services Section of the Division performed more than 4 000 autopsies on poultry during the year under review.

Infectious bronchitis

Infectious bronchitis was not as much of a problem this year as it has been in previous years in the Natal Region, mainly as a result of earlier vaccination and the use of a newly released vaccine.

Thirty-five cases were reported from the Western Cape Region.

Infectious coryza

A few cases were reported from the Highveld, Eastern Cape and Karoo and Western Cape Regions.

Chronic respiratory disease (Mycoplasmosis)

The Regional veterinary laboratory at Stellenbosch diagnosed 72 cases and the veterinary laboratories at Kroonstad and Potchefstroom 123. The ultimate control of the disease depends on both good management practices and the creation of mycoplasma-free breeder flocks from which commercial broilers and layers may be obtained.

Fowl pox

Sporadic cases occurred in all the Regions except the Northern and Eastern Transvaal Region.

Infectious bursitis (Gumboro)

In the Highveld Region there were 25 confirmed cases and in the Western Cape Region 131.

The newly imported inactivated oil-based vaccine for use in parent stock at 18-30 weeks of age should result in better protection for susceptible young chicks.

Epidemic tremor

No cases were reported.

Marek's disease

Outbreaks were reported from all Regions except the Northern and Eastern Transvaal Region.

Vaccination does not always appear to be successful. The veterinary laboratory at Kroonstad proved that vaccination was not very successful with high ambient temperatures.

Lymphoid leucosis complex

The Regional veterinary laboratory at Stellenbosch reported 5 cases, the veterinary laboratory at Kroonstad 12 and the veterinary laboratory at Potchefstroom 41.

Trichomoniasis

The disease was diagnosed in pigeons in the Highveld Region.

Viral arthritis

Was diagnosed in the Western Cape Region.

Ascites

A high incidence of ascites occurred in the Johannesburg State veterinary area during the winter months. Mortality due to this condition is very highly correlated with the level of management. Strangely enough, well managed farms have a high mortality percentage.

Mushy chick disease

A hatchery in the Highveld Region lost 200 out of 2 000 chicks as a result of *E. coli* infection.

Myopathic syndrome

A myopathic syndrome in young broilers between the ages of 8 and 12 days causing paresis and paralysis was encountered in the Western Cape Region. Only chicks reared on a mash containing a new coccidiostat were affected. Since the withdrawal of the new coccidiostat no further cases have occurred.

Diseases of pigs

Vibronic dysentery

Sporadic outbreaks were recorded in the Western Cape Region.

The general use of antibiotic additives over the weaning period has greatly reduced the incidence of the disease.

A problem that has now emerged is that anti-dysentery drugs in feedstuffs are able to treat the incubation period of the disease but are not sufficiently concentrated to eliminate all pathogenic treponemas present in the gut; the pathogens then multiply and redistribute in the colon, producing a more severe type of dysentery, where drugs currently in use are ineffective.

Two outbreaks were recorded in the Eastern Cape and Karoo Region.

Respiratory disease syndrome

No outbreaks were recorded in the Western Cape Region this year.

Eight thousand doses of *Pasteurella multocida* vaccine have been used on 8 farms.

A survey undertaken this year at Spekenam showed that 3 772 (23,6 %) of the 16 008 lungs examined had lesions.

This syndrome was also diagnosed on one farm in the Eastern Cape and Karoo Region and a few isolated cases occurred in the Natal Region.

Spirochaetosis

No cases were reported.

"Smedi"/Parvo virus infection

Two outbreaks with 5 % abortions occurred in the Potgietersrus State veterinary area.

Serum from 13 farms in the Western Cape Region was tested and positive *Parvo virus* titres were found in most samples.

Colibacillosis

This was the biggest problem that pig farmers had to contend with in the Natal Region. Extensive use of the available vaccine has given very good results on most farms, but in a few cases special vaccine had to be prepared.

Sporadic deaths occurred in the Western Cape Region.

Rota-virus disease

Three outbreaks were recorded in the Western Cape Region in piglets 7 to 20 days of age. Treatment with antibiotics was ineffective, but regular dosing with a glucose-electrolyte solution was beneficial.

Deficiency and nutritional conditions

With the ever-increasing value of livestock, farmers are paying far more attention to nutrition and supplementary feeding, so that few serious problems resulting from malnutrition were encountered.

Phosphate deficiency was seen throughout the Free State Region as a result of drought conditions. A severe outbreak of aphosphorosis in

cattle was encountered in the Pretoria State veterinary area. No supplements were fed and the serum phosphate levels were less than 50 % of normal levels. Low phosphate levels were also found in blood samples taken from cattle in the Albany district.

A *copper* deficiency caused swayback in lambs in almost all coastal areas in the Western Cape Region.

Analysis of artificial pastures from 16 farms in the Natal Region revealed that 9 farms were copper deficient.

Magnesium deficiency was encountered in the Districts of Albany and Bethlehem. The State Veterinarian at Irene treated magnesium deficient Karakul sheep successfully with magnesium sulphate.

Iron deficiency occurred in pigs in the Port Elizabeth district.

A *cobalt* deficiency has been confirmed in sheep in the Western Cape Region.

Cases of white muscle disease caused by a *selenium* deficiency have been diagnosed in the Western Cape, Transvaal and Free State Regions.

A considerable number of cases of *pregnancy toxæmia* (domsiekte) were reported in the Free State, Eastern Cape and Karoo, Highveld and Western Cape Regions.

Sporadic cases of *milk fever* were reported from all the regions.

A few cases of *acidosis* were diagnosed in the Free State, Highveld and Northern and Eastern Transvaal Regions.

Abomasal ulceration was seen in sheep in feedlots in the Kuruman district. In one case 31 sheep died as a result of perforating ulcers. Stress combined with a high energy feed seemed to be the predisposing factor.

POISONING

Mineral poisoning

Accidental intake of poison again accounted for substantial mortality among livestock.

Arsenical poisoning was responsible for the death of 13 cattle in the Transvaal Region, 23 cattle in the Eastern Cape and Karoo Region, 8 stud Brahman heifers in the Free State Region, 7 cattle in the Natal Region and 40 sheep and 3 cattle in the Highveld Region.

Lead poisoning was diagnosed as the cause of death of 3 cattle in the Highveld Region, 16 cattle in the Free State Region, 5 cattle in the Transvaal Region, 4 cattle in the Eastern Cape and Karoo Region and 6 cattle in the Natal Region.

Dieldrin accounted for the death of 5 calves and a cat in the Highveld Region and 2 horses in the Transvaal Region.

Organophosphatic compounds were responsible for the death of 6 cattle and 30 guinea fowl in the Highveld Region, 9 cattle and 13 stud Merino rams in the Eastern Cape and Karoo Region, 2 horses in the Natal Region, 1 horse and

6 calves in the Free State Region and 34 cattle in the Northern and Eastern Transvaal Region.

Urea poisoning again accounted for the death of 87 cattle and one sheep in the Natal Region, 2 goats and 30 sheep in the Highveld Region, 10 cattle in the Eastern Cape and Karoo Region, 26 cattle and 17 sheep in the Northern and Eastern Transvaal Region, 20 cattle in the Transvaal Region and 126 sheep in the Western Cape Region. In the Vryburg, Kuruman and Kimberley districts, urea poisoning was also responsible for mortality among cattle and sheep.

Sixty-five pigs died when whey from a local cheese factory at Ladismith (CP) had accidentally been mixed with brine. In the Northern and Eastern Transvaal Region 2 pigs died of *sodium chloride* poisoning and in the Eastern Cape and Karoo Region 5 sheep died.

Seventy dairy cows died of *nitrate* poisoning after grazing heavily fertilised rye grass.

Propentafos was used as an experimental cattle dip in the Rustenburg district and 46 cattle were poisoned, 11 of which died.

In the Bethlehem district 2 cattle died after being maliciously poisoned with a *carbamate* containing substance, which was added to their meal.

Triadimefon was responsible for the death of 4 cattle and *paraquat* for the death of 292 sheep in the Northern and Eastern Transvaal Region.

Dogs were poisoned with *strychnine*, *warfarin* and *toxaphene*.

Two outbreaks of *enzootic icterus* (chronic copper poisoning) were recorded in the Free State Region, one in the Highveld Region and nine in the Eastern Cape and Karoo Region.

Plant poisoning

The following plants were responsible for livestock losses in the various regions:

Natal Region

Homeria and *Moraea* spp. (tulp) (420 cattle), *Lantana camara* (44 cattle and 30 sheep), *Senecio* spp. (sprinkaanbos) (63 cattle and 5 sheep), *Pachystigma pygmaeum* (gousiekte) (1 bovine), *Cestrum laevigatum* (inkberry) (12 cattle), *Vinca major* (periwinkle) (3 cattle), *Matricaria nigellaefolia* (staggers) (14 cattle), *Ornithogalum*spp. (chinkerinchee) (6 cattle), *Lippia* spp. (12 cattle), plants containing prussic acid (1 bovine).

Western Cape Region

Galenia africana (kraalbos), *Cotyledon* spp. (krimpsiekte), *Tribulis terrestris* (common dubbeltjie), *Asaemia axillaris* (vuursiektebossie), *Asclepias fruticosa* (melkbos), *Ornithogalum* spp., *Kalanchoë* spp., *Salsola* spp., *Argemone subfusiformis*, *Melianthus* spp., *Cynachum* spp., *Quercus* spp., *Lupinus* spp., *Hyaenanche globosa* (wolwegif), *Zygophyllum microcarpum*

(sandrepuis), *Althanasia trifurcata* (4 horses), plants containing prussic acid (334 sheep).

For the first time in the history of South Africa, rye grass poisoning was confirmed by the Regional veterinary laboratory at Stellenbosch. Deaths were recorded in cattle and sheep in the Bredasdorp, Malmesbury, Ceres and Calvinia districts. A species of *Anguina* nematode as well as a *Corynebacterium* species have been isolated from the seeds of toxic rye grass pastures.

Free State Region

Amaranthus spp. (14 sheep and 1 bovine), *Argemone* spp. (84 sheep), *Homeria* and *Moraea* spp. (tulp), *Ornithoglossum* spp. (slangkop), *Crotolaria* spp., *Dipcadi glaucum* (wild onion), *Nerine laticoma*, *Tribulus terrestris*, *Hertia pallens* (Springbokbossie) (151 sheep).

Highveld Region

Homeria and *Moraea* spp. (tulp) (7 cattle), *Ornithoglossum* spp. (6 cattle), *Cucumis* spp., *Tribulus terrestris*, plants containing prussic acid, *Pachystigma pygmaeum* (gousiekte) (10 sheep).

Eastern Cape and Karoo Region

Homeria and *Moraea* spp. (tulp), *Tribulus terrestris*, *Galenia africana*, *Senecio* spp., *Geigeria* spp., *Melica decumbens*, *Asaemia axillaris*, plants containing prussic acid.

Transvaal Region

Homeria and *Moraea* spp. (108 cattle), *Dichapetalum cymosum* (gifblaar) (40 cattle), *Lantana camara* (55 cattle and 25 sheep) and *Senecio* spp. (106 sheep).

Northern and Eastern Transvaal Region

Dichapetalum cymosum, *Pavetta* spp., *Fadogia* spp., *Lantana camara*.

Toxins

Another outbreak of kikuyu grass poisoning occurred in the Natal Region.

The poisoning followed on an army worm migration. At least 80 deaths among cattle were reported on 6 farms. The toxic principle has not been identified.

Deaths among porkers in the Western Cape Region were caused by a *citrinin* toxin.

Pithomyces chartarum found on dry material on a few ostrich farms in the Western Cape was responsible for the death of up to 40 % of young birds in the age group 6 to 8 months. Cases of *facial eczema* were confirmed in the Western Cape Region.

Deaths due to *Diplodia maydis* poisoning were encountered in the Transvaal (2 cattle) and the Natal (13 cattle) Regions.

INTERNAL PARASITES

Serious problems with internal parasites were encountered in all the Regions.

Haemonchus spp. (wire worm) was the parasite which caused most problems in all the Regions. The State Veterinarian at Bloemfontein reported 2 outbreaks in sheep with 40 and 8 deaths respectively. In the Ellisras State veterinary area 53 sheep died of haemonchosis.

Oesophagostomum spp. (nodular worm) together with wire worm was the most important parasite in the Highveld and Natal Regions. At abattoirs in the Natal Region 210 819 sheep intestines were condemned owing to nodular worm infestation.

Problems were also experienced in the Northern and Eastern Transvaal, Eastern Cape and Karoo and Free State Regions. *Oesophagostomum* spp. caused cattle losses in the Rustenburg State veterinary area.

Trichostrongylus spp. (bankrupt worm) was responsible for losses in the Western Cape and Eastern Cape and Karoo Regions.

Libyostrongylus douglassi was responsible for the death of 4 young ostriches in the Gordonia district.

The brown stomach worm *Ostertagia* spp. was diagnosed in the Western Cape and Eastern Cape and Karoo Regions.

Nematodirus spp. (long-necked bankrupt worm) caused problems in the Free State and Eastern Cape and Karoo Regions.

Trichuris ovis (whipworm) occurred only in the Eastern Cape and Karoo Region.

Fasciola spp. (liver fluke) was fairly prevalent in the Transvaal Region where 10,3 % of cattle livers and 0,5 % of sheep livers were condemned at abattoirs. In the Natal Region 85 074 sheep and 26 246 cattle livers were condemned at abattoirs owing to fasciola infestation. The parasite also occurred in the Northern and Eastern Transvaal Region, mainly in cattle, and was also prevalent throughout the Highveld Region.

Conical fluke *Paramphistoma* spp. was a problem only in the Highveld, Free State, Western Cape and Eastern Cape and Karoo Regions.

Tapeworm infestations in both calves and lambs was prevalent throughout all the regions.

Stilesia hepatica (liver tapeworm) was prevalent throughout all the regions and was responsible for the condemnation of 230 225 sheep livers at abattoirs in the Natal Region, 20 % of sheep livers at the Maitland abattoir and 28,5 % of sheep livers at abattoirs in the Transvaal Region.

The incidence of *measles* infestation in the Transvaal Region was 3,4 % in cattle and 0,5 % in pigs. At the Phalaborwa abattoir in the Northern and Eastern Transvaal Region the incidence was 12 %.

The high incidence of *Taenia multiceps* in sheep on a farm in the Mossel Bay State veterinary area was cause for concern. A vaccine was prepared and gave very promising results.

Coenuris cerebralis infestation is on the increase in the Queenstown State veterinary area.

Approximately 4% of cattle slaughtered at the Port Elizabeth abattoir were infected with *Parafilaria bovicola*. In the Northern and Eastern Transvaal Region the incidence was as high as 10% on some farms.

Pneumostrongylus spp. was found in the lungs of impala in the Kruger National Park and the bile ducts of all hippopotami contained a *Fasciola* spp.

EXTERNAL PARASITES

Ticks were again the most troublesome external parasites encountered throughout the country.

Boophilus spp. (blue tick) was very active in the Highveld, Free State, Natal, Eastern Cape and Karoo, Transvaal and Western Cape Regions.

Rhipicephalus appendiculatus (brown ear tick) created severe problems in the Northern and Eastern Transvaal, Highveld and Free State Regions. This tick was responsible for abscesses in the middle ear and brain, especially in goats.

R. evertsi (redlegged tick) was very prevalent in the Highveld, Eastern Cape and Karoo and Natal Regions.

The bontlegged tick *Hyalomma* spp. was very troublesome in all the regions with the exception of the Eastern Cape and Karoo Region.

Amblyomma spp. (bont tick) was troublesome in the endemic areas in the Natal, Transvaal, Northern and Eastern Transvaal, Natal and Eastern Cape and Karoo Regions.

Paralysis caused by *Ixodes rubicundus* (Karoo paralysis tick) was a serious problem in the Eastern Cape and Karoo Region, where sheep had to be dipped at least 3 to 4 times during the period when this tick was active. Problems were also encountered in the Western Cape Region.

As a result of the compulsory dipping campaign against sheep scab the incidence of sheep lice *Damalinea ovis* and keds *Melophagus ovinus* was considerably lower.

The incidence of *Psorergates ovis* (Australian itch mite) in the Western Cape Region was apparently not affected by the dipping campaign against sheep scab. Experiments were conducted by a private company in the Swellendam area and results indicated that the available dipping compounds do not kill off all the mites in a single dipping.

Blowfly strike was still prevalent in the Eastern Cape and Karoo and Western Cape Regions.

Experiments with new insecticides were carried out in the Swellendam district by five companies. Two compounds gave exceptionally good results in that they gave protection for a period of at least 3 months.

Stomoxys calcitrans (stable fly) was a troublesome pest on many farms in the Transvaal and Western Cape Regions.

Simulium spp. (midges) occurred sporadically along the banks of the Orange River. Water level control seems to be working well. Certain areas where rapids occur may have to be treated chemically.

Tampanis continue to be a problem in the Kalahari.

Demodex canis was diagnosed in dogs throughout the country.

ARTIFICIAL INSEMINATION

The testing of bulls at AI Centres was carried out by the Regional veterinary laboratories at Allerton and Stellenbosch and the veterinary laboratory at Grahamstown as well as by the Section for AI and Reproduction of the Division of Veterinary Services, in conjunction with the Veterinary Research Institute.

Final recommendations for registration or re-registration rest with the Section for AI and Reproduction.

During the year under review, 275 tests were carried out on 240 bulls at AI centres.

Leptospira hardjo was diagnosed serologically in 3 bulls. Two of these were treated and re-registered after retesting. Another thirteen bulls had low titres, but were all classified negative on being retested. Some of them were treated with antibiotics.

On the 240 bulls at the AI Centres, 67 were serologically positive for IBR/IPV. This increase was mainly due to an outbreak of infectious balanoposthitis at the Taurus AI Centre in Transvaal during August 1980.

The total number of doses of semen sold by AI Centres during the year under review was 618 383 (541 346), which is an increase of 77 037 doses over the number sold the previous year. Dairy breeds contributed 474 117 doses and beef breeds 144 266 doses.

The breed classification of bulls at official AI Centres is as follows:

Friesland 166, Jersey 33, Ayrshire 11, Guernsey 12, Aberdeen Angus 1, Africander 1, Bonsmara 4, Brahman 6, Brown Swiss 2, Hereford 1, Simmentaler 2, Sussex 1.

During the year under review a total of 54 cows were registered as ovum donors for the purpose of embryo transfers.

STOCK INSPECTION SERVICES

There was a deterioration in the staff position with regard to stock inspectors.

During the year under review 59 new appointments were made, 98 officials resigned and 4 died. The shortage of stock inspectors has reached a critical stage.

ANIMAL HEALTH EXTENSION SERVICE

The volume of extension services rendered to farmers by officers of the Division of Veterinary

TABLE 3 - AI courses and number of successful candidates

Courses offered by	Registerable inseminators		Owner inseminators		Labourers	
	Courses	Successful candidates	Courses	Successful candidates	Courses	Successful candidates
AI and Reproduction Section	4	78	4	57		
SV Potchefstroom	4	50	8	132		
			cattle			
			1	10		
			sheep			
SV Bloemfontein			3	59		
SV Mossel Bay			9	129		
SV Pietermaritzburg			7	98		
Taurus AI Co-op			110	777		218
SAAU Training Centre at Boskop					10	95
Total	8	128	142	1 262	10	313

Services has increased substantially.

During the year farmers' days were arranged and addressed by State veterinarians, articles on stock diseases were compiled and published in local papers and agricultural journals, radio talks were given, farmers' societies and study groups were addressed, short courses on stock diseases were offered to farmers and vaccination and dosing programmes were compiled and distributed among the farming community.

A large number of individual farmers were given advice by State veterinarians and stock inspectors during visits to farms or by telephone or letter.

Many prospective farmers at agricultural colleges were given lectures on stock diseases by State veterinarians.

IMPORT AND EXPORT CONTROL

Import control

One of the main functions of the Division of Veterinary Services is to prevent the introduction of stock diseases from other countries. For this purpose use is made of quarantine stations situated at Jan Smuts Airport, Durban, Cape Town and Walvis Bay.

Numerous kinds of animals were imported in accordance with requirements stipulated in the permits issued by the Division.

	From neighbouring territories	From overseas
Cattle	6 990	35
Horses	253	90
Sheep	44	104
Pigs	176	-
Dogs	1 027	1 887
Cats	647	995
Poultry	-	5 466
Birds	3 991	32 593
Game	20	25
Rabbits	-	6
Primates	2	2 708
Reptiles	-	90
Rodents	106	501
Alligators	-	20
Fish	1 541	1 818 378
Crustaceans	-	3 225
Ticks	-	50
Beetles	-	6 500

At Jan Smuts Airport 16 dogs, 4 cats, 3 rabbits, 241 birds, 4 turtles and 1 snake were seized because of irregularities. Six dogs, 1 cat, 3 rabbits, 5 birds and the snake were destroyed without compensation at the owner's request. The remaining animals were returned to sender.

Numerous different products were also imported in accordance with permits issued by the Division. Sixty-three fertile eggs, 214 kg of biltong, 11 skins, 6 kg of raw meat and 2 500 doses of vaccine were brought in illegally. All these products were destroyed. In addition 13 elephant tusks weighing some 140 kg were seized for illegal entry, sprayed with formalin and released to the customs authorities for further attention. The owner was prosecuted and fined R800 for contraventions of the Animal Diseases and Parasites Act (Act 13 of 1956) and his vehicle and other articles were seized by Nature Conservation and Customs Authorities.

Export control

Officers of the Division of Veterinary Services carried out veterinary examinations for export purposes, in accordance with the requirements of importing countries, in respect of the following animals, reptiles and insects:

	To neighbouring territories	To overseas countries
Cattle	47 404	4 770
Equidae	2 584	37
Sheep	41 546	10
Goats	10 085	150
Pigs	1 665	-
Dogs	1 107	814
Cats	177	184
Poultry	553 638	473 865
Birds	338	115 496
Game	311	46
Rabbits	2	-
Rodents	100	40
Frogs	-	60
Seals	-	57
Primates	2	1
Reptiles	-	31
Beetles	-	97

--Certificates were also issued by officers of the Division for a large variety of products intended for export.

TRAINING

State veterinarians of the Division gave lectures on veterinary science at all the colleges of agriculture.

The in-service training of members of the inspectorate staff was continued and 3 courses for 58 officials were held during the year. 675 officials have now been trained in this way.

The in-service training of members of the stock inspectorate staff to perform tuberculin tests was also continued and one course for 23 officers was held.

LEGISLATION

During the year under review the following Government notices were published in accordance with the *Animal Diseases and Parasites Act, 1956 (Act 13 of 1956)* and the *Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967)*:

Government Notice R.1684 of 15 August 1980: Amendment of Standing Regulations.

Government Notice R.1571 of 1 August 1980:

Exclusion of certain abattoirs from the application of certain provisions of the Act.

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

Visits were paid to the Head Office of the Division by scientists from Bophuthatswana, Transkei and Venda.

Officials from Head Office paid visits to Transkei and Swaziland.

Liaison with overseas countries

Scientists from Australia, Germany, Portugal, Great Britain and New Zealand paid official visits to the Head Office of the Division.

Officials of the Division paid visits to Denmark, Holland, Germany, Belgium, France, Israel, Great Britain, Ireland and Taiwan.

CLINICAL SERVICES

State veterinarians again rendered veterinary services to all State-owned herds and flocks and also carried out clinical services for farmers whenever their official duties permitted, especially in areas where there were no private veterinary practitioners.

During the year State veterinarians collected R39 465 for professional services and R8 226 for travelling expenses.

Vaccines to the value of R121 were sold by State veterinary offices. Fees for laboratory

investigations amounted to R27 969 and those for meat and game carcase inspections to R558 459.

Fees for keeping animals and birds in quarantine amounted to R43 681 and sundry revenue to R91 226.

The Division received R472 581 for carcases of animals slaughtered and approved for human consumption in accordance with the bovine tuberculosis eradication scheme. The grand total of revenue received by the Division of Veterinary Services amounted to R1 241 728, all of which was paid into the General Revenue account.

DIAGNOSTIC SERVICES

Diagnostic services were rendered by three regional veterinary laboratories - at Middelburg (CP), Stellenbosch, and Allerton - and also by smaller veterinary laboratories at Grahamstown, Queenstown, Kroonstad, Potchefstroom and Bloemfontein. An additional laboratory at Skukuza in the Kruger National Park keeps the Division informed of diseases occurring in game which are transmissible to domestic animals.

The AI and Reproduction and Poultry Diagnostic Services sections of the Division at Onderstepoort offer a more comprehensive service to poultry and cattle farmers.

There was an increase of 45,8 % in the diagnostic services rendered by the Division, as reflected in Table 4. The increase was due mainly to an increase in the number of tests carried out under the brucellosis eradication scheme.

TABLE 4 - Diagnostic services

	1979/80	1980/81
<i>Brucella</i> - Rose Bengal tests	149 385	289 782
<i>Brucella</i> - complement fixation tests	42 385	142 794
<i>Brucella</i> - tube agglutination tests	29 871	7 632
<i>Brucella</i> - milk ring tests	3 936	3 079
<i>Brucella</i> - rivanol tests	-	3
<i>Brucella</i> - mercapto-ethanol test	-	3
FA-tests	2 027	2 154
PPLO-tests	10 149	11 766
BWD-tests	387	2 023
HI-tests	26 124	17 066
Inf. bursal disease serological test	3 698	3 777
Poultry <i>Mycoplasma</i> isolations	369	226
Bovine <i>Mycoplasma</i> isolations	2	12
Vibriosis	308	1 465
Trichomoniasis	306	1 443
John's disease	4	32
Leptospirosis	1 380	466
<i>Actinobacillus seminis</i>	13 110	17 492
Pasteurellosis	353	512
Chlamydiosis	392	734
<i>Chlamydia</i> -isolations	107	99
Antibiograms	1 092	1 586
Serotyping of cultures	683	1 784
Skin scrapings	439	625
Faeces examinations	7 743	11 122
Larval cultures	437	554
Identification of internal parasites	1 791	648
Identification of external parasites	189	379
Identification of plants	86	75
Mastitis milk examinations	32 918	34 646
Semen	6 028	17 445
Sheath washings	1 437	1 947

	1979/80	1980/81		1979/80	1980/81
Vaginal swabs	1 646	2 426	<i>Trichinella</i>	120	103
Placentas	72	79	Smears	10 446	7 365
Aborted foetuses	283	406	Clinical examinations	33 007	14 717
Haematology	10 608	9 256	Post mortem examinations	3 312	2 607
Biochemical	31 508	28 150	(Poultry excluded)		
Toxicology	333	731	Post mortem examinations	10 634	9 227
Dipping samples tested	200	363	(poultry)		
Protozoological	559	540	Poultry samples examined	13 250	12 054
Bacteriological	33 954	41 030	Antibiotic residue test	212	-
Virological	1 060	7 643	Dourine tests	2 339	1 539
Biological	515	448	<i>Coxiella burnetti</i>	9	16
Histopathological	1 536	3 864	Examination of peri-natal lambs	28	16
Abattoir by-products tested	1 076	787	Pig <i>Mycoplasma</i> isolations	88	-
Abattoir bacterial counts	564	2 851			
			Total	493 291	719 589

TABLE 5 - Stock census

Region national state	Cattle	Sheep Woolled	Non- woolled	Goats Non- woolled	Horses	Donkeys and Mules	Pig	Fowls	Dogs
Western Cape	361 972	3 136 687	1 334 501	303 717	17 491	8 277	191 924	8 814 848	40 330
Eastern Cape and Karoo	943 796	7 454 641	2 341 058	1 384 110	32 420	8 976	67 634	3 177 463	68 225
Transvaal	2 020 088	3 106 201	321 649	80 871	36 556	6 558	245 949	9 833 137	412 435
Natal	1 488 812	981 291	105 712	116 087	24 161	2 447	139 191	3 491 335	196 895
Free State	1 546 128	2 981 153	5 595 407	410 508	46 518	13 134	88 218	749 857	60 713
Highveld	2 064 754	2 808 285	342 989	46 259	47 397	4 578	192 774	3 941 275	172 665
Northern and Eastern Transvaal	1 037 912	267 837	155 238	120 456	8 140	14 220	110 062	1 228 437	69 697
Total	9 463 462	20 736 095	10 196 554	2 462 008	212 683	58 190	1 035 752	31 236 352	1 020 960
Gazankulu	213 763	-	93 260	92 441	11	5 963	17 134	276 263	29 709
Lebowa	468 278	Not divided	68 256	378 076	114	25 099	33 382	538 409	40 422
KwaZulu	1 357 141	50 700	96 471	564 634	13 118	20 960	30 755	1 038 450	311 428
Qwaqwa	8 154	Not divided	1 143	4 943	400	68	8 436	12 300	1 600
Ciskei	152 111	246 798	Not divided	222 605	4 785	768	17 724	106 905	21 939
Total	2 199 447	297 498	169 130	1 262 699	18 428	52 858	107 431	1 972 327	405 098
Grand total	11 662 909	21 033 593	10 365 684	3 724 707	231 111	111 048	1 143 183	33 208 679	1 426 058

TABLE 6 - Distribution of cattle

Region, national state	White owners	Black owners
Western Cape	356 794	5 178
Eastern Cape and Karoo	908 887	34 909
Transvaal	1 852 998	167 090
Natal	1 224 225	264 587
Free State	1 521 549	24 579
Highveld	1 972 061	92 693
Northern and Eastern Transvaal	931 997	105 915
Total	8 768 511	694 951
Gazankulu	-	213 763
Lebowa	-	468 278
KwaZulu	-	1 357 141
Qwaqwa	-	8 154
Ciskei	-	152 111
Total	-	2 199 447
Grand total	8 768 511	2 894 398

MEAT HYGIENE ADMINISTRATION

Abattoirs

On 31 March 1981, the following numbers of abattoirs were registered:

Red meat abattoirs	809
Poultry abattoirs	226
Rabbit abattoirs	9
Total	1 044

With the regrading of abattoirs - now almost complete - on the basis of the species slaughtered and daily throughout, in accordance with Government Notice 211 of 1980-02-08, the position is now as follows:

TABLE 7 - Grade and Class of Abattoir

Region	A	AP	AH	B	BP	BH	C	CP	CH	D	DP	DH	E	EP	EH
Transvaal	11	7	-	5	6	-	5	15	1	31	5	2	14	10	-
Northern and Eastern Transvaal	1	-	-	1	-	-	10	3	-	32	4	-	28	3	1
Highveld	2	-	-	8	1	-	17	2	-	18	-	-	11	28	-
Orange Free State	2	-	-	-	2	-	3	-	-	16	2	-	45	33	-
Natal	4	2	-	7	6	-	24	8	1	25	7	2	21	19	-
Eastern Cape and Karoo	2	2	-	1	-	-	6	3	-	17	5	-	57	29	1
Western Cape	2	5	-	3	3	-	7	2	-	29	5	-	50	9	1
Total	24	16	0	25	18	0	72	33	2	168	28	4	226	131	3
KwaZulu	-	-	-	-	-	-	2	-	-	38	-	-	12	-	-
Lebowa	-	-	-	-	-	-	5	-	-	82	-	-	57	-	-
Gazankulu	-	-	-	-	-	-	3	-	-	54	-	-	41	-	-
Total	0	0	0	0	0	0	10	0	0	174	0	0	110	0	0
Grand Total	24	16	0	25	18	0	82	33	2	342	28	4	336	131	3

One slaughter unit (S.U.)	=	1 head of cattle
	=	1 equine
	=	3 calves
	=	15 sheep/goats or 15 sheep and goats together
	=	5 pigs
	=	4 ostriches

Red meat abattoirs

Grade A	-	more than 100 SU per day or if for export
Grade B	-	more than 50 but not more than 100 SU per day
Grade C	-	more than 15 but not more than 50 SU per day
Grade D	-	more than 3 but not more than 15 SU per day
Grade E	-	not more than 3 SU per day

Poultry abattoirs

Grade AP	-	more than 10 000 head of poultry per day or if for export
Grade BP	-	501 - 10 000 head of poultry per day
Grade CP	-	201 - 500 head of poultry per day
Grade DP	-	51 - 200 head of poultry per day
Grade EP	-	not more than 50 head of poultry per day

Rabbit abattoirs

Grade AH	-	more than 10 000 rabbits per day or if for export
Grade BH	-	501 - 10 000 rabbits per day
Grade CH	-	201 - 500 rabbits per day
Grade DH	-	51 - 200 rabbits per day
Grade EH	-	not more than 50 rabbits per day

Sterilisation plants

The following number of plants are at present registered under Act 36 of 1947 in the various Regions:

Transvaal	19
Northern and Eastern Transvaal	2
Highveld	6
Orange Free State	6
Natal	9
Eastern Cape and Karoo	9
Western Cape	22
Total	73

This Division is concerned with inspections and recommendations to the Registrar of Act 36 of 1947 and with the taking of sterile samples for bacteriological analysis.

According to the bacteriological analyses, the main problem in the manufacturing of protein rich by-products is the recontamination which occurs after sterilisation.

Planning

The following services have been rendered to the abattoir industry:

1. Total sets of drawings for new projects evaluated = 204
2. Total sets of drawings evaluated for alterations/improvements = 121
3. Discussions held with owners and consultants = 192
4. Projects found acceptable from the point of view of hygiene = 54
5. Projects visited and inspections carried out at projects under construction = 69

Legislation

During the year under review the following Government Notices were published:

Government Notice 1571 of 1 August 1980 - exclusion of certain abattoirs from the application of certain provisions of the Act.

All abattoirs, except grade A abattoirs, are

TABLE 8 - Meat Imports/Exports

Imports (kg)	Neighbouring states	Overseas	Total
Meat products	-	2 314 784	2 314 784
Beef	7 082 469	2 525 190	9 607 659
Mutton	-	3 077	3 077
Pork	-	36 287	36 287
Guinea Fowl/Turkey	-	200 772	200 772
Poultry	615	1 894 851	1 895 466
Total	7 083 084	6 974 961	14 058 045
Exports (kg)			
Meat products	-	23 716	23 716
Beef	85 631	1 681 544	1 767 175
Mutton	7 360	-	7 360
Pork	715	1 183 041	1 183 756
Venison (Western Cape)	-	1 445 579	1 445 579
Ostrich	-	133 020	133 020
Poultry	74 070	4 167 139	4 241 209
Total	167 776	8 634 039	8 801 815

excluded from the application of the provisions of sections 8, 25, 26, 27, 28 and 29 of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967).

Exemptions

During the year under review, exemption from certain structural requirements was granted to 9 abattoirs, for the duration of their present certificates of approval.

These exemptions have to date not been published in the *Gazette*.

MEAT INSPECTION SERVICES

TRAINING

Great success was achieved during the year under review with the in-service training of officers

TABLE 9 - The total numbers of animals slaughtered in the various regions are as follows

Region	Cattle and calves	Sheep and goats	Pigs	Equidae	Poultry
Transvaal	1 244 514	2 232 234	533 687	2 088	47 548 505
Northern and Eastern Transvaal	*	*	*	*	*
Highveld	200 318	335 857	81 848	-	353 198
Orange Free State	199 536	895 263	59 358	-	*
Natal	283 974	1 145 961	276 471	-	56 148 823
Eastern Cape and Karoo	*	*	*	*	*
Western Cape	309 167	1 590 938	308 926	510	41 470 852
Total	2 237 509	6 200 253	1 260 290	2 598	145 521 378

*Figures not available

TABLE 10 - The total numbers of animals/carcases subjected to ante-mortem and post-mortem inspection by officers of this Division are shown in the following table

Region	Cattle and calves	Sheep and goats	Pigs	Equidae	Game	Poultry
Transvaal	997 507	1 929 209	338 975	1 783	*	-
Northern and Eastern Transvaal	-	-	-	-	*	-
Highveld	-	-	-	-	65 724	-
Orange Free State	82 157	368 666	23 158	-	*	-
Natal	211 953	1 013 413	197 271	-	*	8 176 177
Eastern Cape and Karoo	*	*	*	*	*	*
Western Cape	-	-	63 815	-	419 476	684 097
Total	1 291 617	3 311 288	623 219	1 783	485 200	8 860 274
% of total slaughterings	57,726	53,405	49,950	68,63	-	6,089

*Figures not available

TABLE 11 - The total numbers of carcasses inspected by health inspectors employed by local authorities were as follows

Region	Cattle and calves	Sheep and goats	Pigs	Equidae	Poultry
Transvaal	241 361	296 054	191 656	-	-
Northern and Eastern Transvaal	*	*	*	*	*
Highveld	195 101	322 043	79 831	-	-
Orange Free State	117 379	526 597	36 200	-	-
Natal	55 978	121 504	20 779	-	-
Eastern Cape and Karoo	*	*	*	*	*
Western Cape	282 844	1 353 154	141 325	510	-
Total	892 663	2 619 352	469 791	510	-
% of total slaughtered	39,895	42,246	37,276	19,630	-

*Figures not available

TABLE 12 - The total numbers of carcasses inspected by private veterinarians and medical practitioners were as follows

Region	Cattle and calves		Sheep and goats		Pigs		Equidae	Poultry
	Veterinary	Medical practitioners	Veterinary	Medical practitioners	Veterinary	Medical practitioners		
Transvaal	-	-	-	-	-	-	-	-
Northern and Eastern Transvaal	*	*	*	*	*	*	-	-
Highveld	-	1 227	-	2 306	-	487	-	-
Orange Free State	-	-	-	-	-	-	-	-
Natal	4 228	2 755	2 969	2 507	56 225	602	-	-
Eastern Cape and Karoo	*	*	*	*	*	*	-	-
Western Cape	-	-	-	-	-	-	-	-
Total	4 228	3 982	2 969	4 813	56 225	1 089	-	-
% of total slaughtered	0,189	0,179	0,048	0,078	4,461	0,086	-	-

of this Division.

The following courses on Meat and Abattoir Hygiene were presented:

One 10-day course for State Veterinarians/Veterinary Meat Inspectors. This course was attended by 12 Veterinarians.

Two 14-day courses for Control and Principal Meat Inspectors - 24 officers attended.

GRAZING UTILISATION RESEARCH

Natural grazing

Except for the Karoo and the Western coastal areas, most of the pasture areas of the Republic had a good rainy season and above-average precipitations were recorded in the central grassveld areas. Despite these favourable conditions it appears that the natural pastures in large areas are in a state of deterioration.

One major cause of the deterioration of the veld is overestimation of the long-term production capacity of the natural pastures. A study undertaken in the False Thornveld of the Eastern Cape Region revealed that the veld has already deteriorated so far that the present grazing capacity is only 52 % of the potential grazing capacity for this veld type. Despite this the stocking rate applied is 46 % higher than the grazing is able to carry at present. It was established in the bushveld areas of the Free State Region that at a stocking rate of over 7 ha/LSU both the livestock and the vegetation are placed under a strain. It has been found that at a stocking rate of 4 ha/LSU, a rate generally applied in the Northern Cape, production per animal is an average of 16 % lower annually than at a stocking rate of 7 ha/LSU and that the basal cover of the veld drops by about 23 % after only three years. Maximum livestock production per unit area is obtained with a stocking rate of 3-4 ha/LSU. This increased production is accompanied by a deterioration in the natural resources, there is a continual shortage of reserve grazing and the slightest dry period takes on the proportions of a serious drought.

Grazing research in several Regions was directed at quantifying veld conditions, identifying the most important pasture plants and pinpointing the factors that limit production so that efficient production systems can be designed. Veld reference points that can be used to monitor changes in the condition of the veld and determine grazing capacity were marked off in the Natal, Eastern Cape and Karoo Regions. Research in the Karoo Region indicated that the percentage crown cover spread is the best criterion for evaluating the cover of the veld.

In an investigation carried out in the Karoo Region the diet and species preferences of Merino and Dorper sheep, Boer goats and Africanders were determined. According to this investigation it appears that the palatable Karoo bush component is grazed mainly during autumn and winter, and the less palatable plants are grazed in spring. The grass component, on the other hand, is grazed mainly in winter. Changes in the floristic composition of karoo veld can be explained on the basis of species preferences of the various kinds of herbivores.

The effect of bush density on grass production was successfully quantified for the first time in the Eastern Cape. It was found that grass production is seriously impaired at a bush density of over 1 000 *Acacia karroo* trees per ha.

This threshold value is affected by the total rainfall. In practice this means that deforestation in the *Acacia karroo* veld of the Eastern Cape Region is justified only if the bush density exceeds 1 000 trees/ha.

The results obtained from the complete production system at the Adelaide Experimental Plot show that not only can the pastures improve but the long-term livestock production can be significantly increased by applying tested veld and livestock management practices and adapting livestock numbers to the available grazing. Over a period of four seasons veld conditions improved by 28 %, and the calculated NFI/ha increased from R2,99 to R13,67. It is estimated that the inclusion of a browser in a cattle production system in this bushveld area could increase red meat production by at least 50 %.

Artificial pastures

Research on indigenous grass species for use in artificial pastures is centred around four species at present, namely *Antheophora pubescens*, *Cenchrus ciliaris*, *Digitaria eriantha* and *Sporobolus fimbriatus*.

Antheophora pubescens is being evaluated on the poor, sandy soils of the Northern Cape. During the 1980/81 season, during which about 85 % of the normal rainfall occurred, the grazing capacity of 2,6 ha/LSU was obtained on artificial *Antheophora* pastures. The long-term grazing capacity of the natural veld of the area is 7 ha/LSU. Cytological investigations were carried out on several promising *Antheophora* selections. It seems possible that apomixis occurs in these species, which would pave the way to the selection of a genetically stable and productive cultivar.

In an investigation aimed at characterising *C. ciliaris* in terms of animal production it was found at the Glen Agricultural Research Institute that the growth curve of *Cenchrus* corresponds largely to that of the natural *Cymbopogon-Themedra* veld. With the same rainfall the phytomass production of *Cenchrus* is 5 times as high as that of the natural veld, however. An average daily mass increase of 1,2 kg/day from birth to weaning was obtained on artificial *Cenchrus* pastures with Simmentaler calves. It was found that under the same environmental conditions *S. fimbriatus* will produce an even higher phytomass yield than *Cenchrus*.

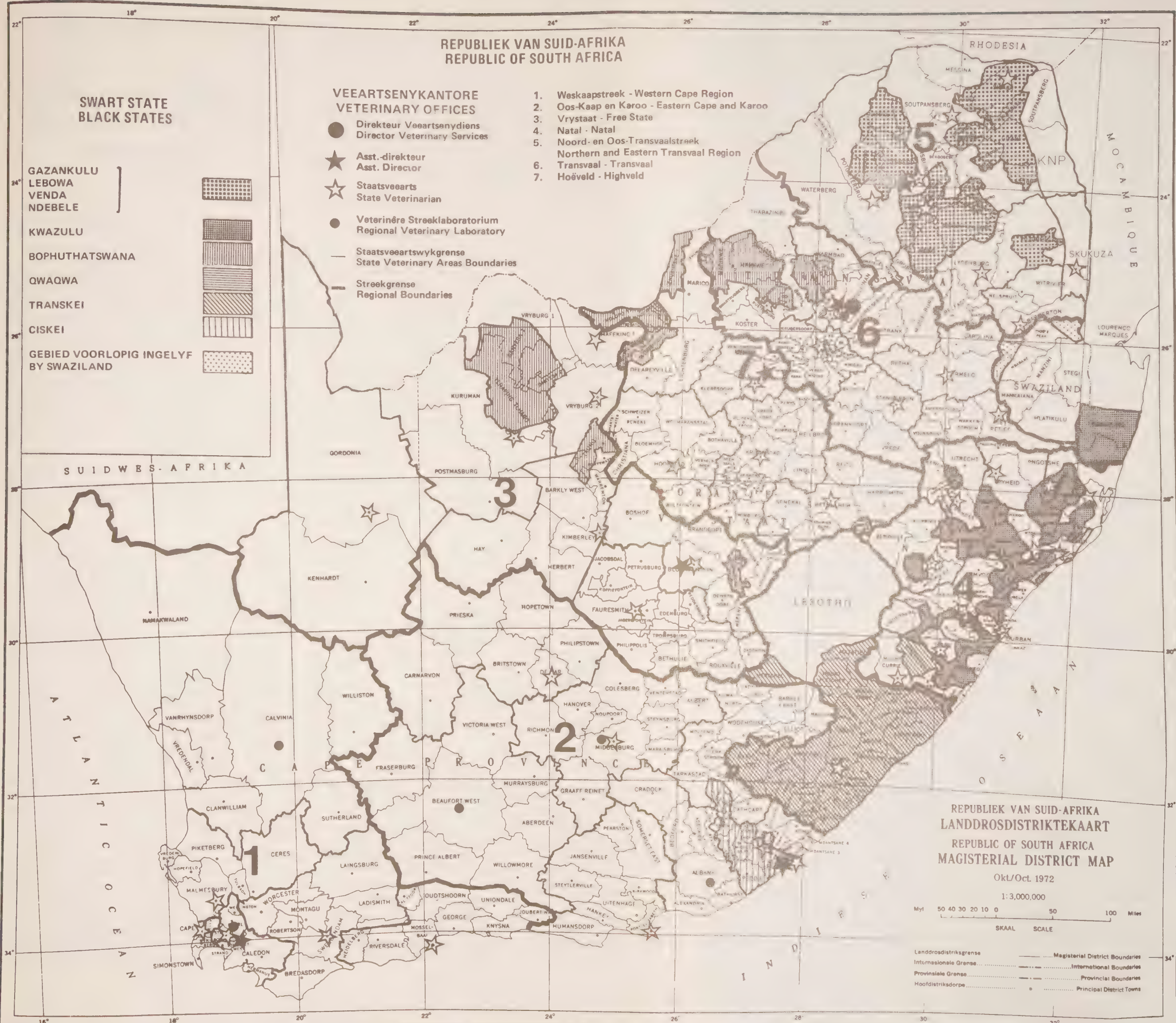
Nurvery and grazing evaluations with Smuts fingergrass (*D. eriantha* subsp. *eriantha*) were continued at the Potchefstroom College of Agriculture. It appears that this grass is entirely suitable for grazing by sheep.

Artificial pastures of both tropical and mediterranean grass species are still being extended in Natal and the Eastern Cape. A survey revealed that about 2 million ha in the Natal Region is suitable for the establishment of pasture and forage crops.

Annual rye grass poisoning, which was reported in South Africa for the first time, caused stock deaths on four farms in the Winter Rainfall Region. Nation-wide surveys that were carried out did not reveal any further farms to be infected. However, there is a possibility that annual rye grass poisoning is already widespread, especially in the winter rainfall areas. Measures have been taken to prevent the importation of rye grass seed that could be contaminated and prevent further outbreaks.

Annual *Medicago* species were established at Glen to determine the possible role of this legume in the Free State. It was found that certain *Medicago* species are well adapted to the severe cold winters of the Free State and yield well during September and October. Yields of as much as 12 tons of dry matter per ha were obtained under irrigation.

Heavy infestations of the pea aphid greatly restricted the expansion of annual medics, especially in the winter rainfall area. It has also been established that the blue-green aphid *Acyrthosiphon kondoi* is now established throughout the Republic and is attacking lucerne plantings. The damage done by the aphids is making it necessary to import and test resistant cultivars.



SWART STATE
BLACK STATES

VEEARTSENYKANTORE
VETERINARY OFFICES

1. Wskaapstreek - Western Cape Region
2. Oos-Kaap en Karoo - Eastern Cape and Karoo
3. Vrystaat - Free State
4. Natal - Natal
5. Noord- en Oos-Transvaalstreek
Northern and Eastern Transvaal Region
6. Transvaal - Transvaal
7. Hoëveld - Highveld

- Direkteur Veeartsenydiens
Director Veterinary Services
- ★ Asst.-direkteur
Asst. Director
- ☆ Staatsveearts
State Veterinarian
- Veterinêre Streeklaboratorium
Regional Veterinary Laboratory
- Staatsveeartswykgrense
State Veterinary Areas Boundaries
- Streekgrense
Regional Boundaries

- GAZANKULU
- LEBOWA
- VENDA
- NDEBELE
- KWAZULU
- BOPHUTHATSWANA
- QWAQWA
- TRANSKEI
- CISKEI
- GEBIED VOORLOPIG INGELYF
BY SWAZILAND

REPUBLIEK VAN SUID-AFRIKA
LANDDROSDISTRIKTEKAART
REPUBLIC OF SOUTH AFRICA
MAGISTERIAL DISTRICT MAP

Okt/Oct. 1972

1:3,000,000

Myl 50 40 30 20 10 0 50 100 Miles

SKAAL SCALE

- Landdrostdistriksgrense
- Internasionale Grense
- Provinsiale Grense
- Hoofdistrikstoele
- Magisterial District Boundaries
- International Boundaries
- Provincial Boundaries
- Principal District Towns

12. Agricultural resource utilisation

RESOURCE CLASSIFICATION AND UTILISATION RESEARCH

Soil science

Soil fertility studies

The fertilising advisory services of the Department analysed 20 000 soil samples and 5 000 plant samples for purposes of giving advice on fertilising. The Department deals with about 200 queries per weekday on soil fertility, plant feeding and fertilising. The research in connection with the development and refinement of extraction methods intended for fertilising advice has made such good progress that a modified ISFEI method can now be proposed as a standard method for referral and communication purposes. This new method will make it easier for fertilising advisers to advise farmers on the use of the 2,9 million metric tons of fertiliser they consume annually.

With a view to improving cultivation practices, research on the incidence of cinnamon and benzoic acid derivatives in soils was continued.

Soil mineralogy

Through its mineralogy, the clay fraction of a soil yields information on the origin of that soil and, because of its very large surface area, it has a disproportionate effect on soil properties. For these reasons the systematic examination, using mainly X-ray powder techniques, of clay mineralogy of representative type profiles collected during the Natural Resources Survey throughout South Africa has been continued. Over 8 000 X-ray diffractograms have been interpreted and progress is being made towards publishing this information.

At the request of Regional offices, other Government departments (e.g. Forestry, Geological Survey) and several private companies, a study of the mineralogy of soils and fertilisers has been undertaken. This has provided information of practical as well as scientific importance.

Studies have continued on the development and refinement of techniques to determine the chemical and mineralogical composition of lime materials, phosphatic fertilisers, fly ash and slags (i.e. industrial and mining wastes). Progress has been made in developing a computer program to make the X-ray diffraction apparatus fully automatic and to analyse lime materials (i.e. to quantify calcite, dolomite and quartz, and determine the degree of purity and crystallinity of these minerals). The value of infra-red spectroscopy in detecting small

amounts of palygoskite and sepiolite in lime materials has been established.

Further work on the distribution and mineralogy of iron and titanium oxides in soil profiles is in progress. Detailed investigations of the effects of isomorphous substitution of aluminium and titanium for iron in goethite and maghemite have been conducted.

Soil chemistry studies

The project on the distribution and properties of lime materials with reference to their suitability for the amelioration of South African soils was continued. Six blast furnace slags and 10 fly ash samples were analysed. It was found that the fly ash sources in the RSA are of the alkaline type and that no acid fly ash occurs. The slags showed neutralisation values of between 50 and 60 % CaCO_3 equivalent and therefore had average acid amelioration properties in comparison with Ca and Mg carbonate. The fly ash samples, on the other hand, yielded values between 3 and 12 % CaCO_3 equivalent, which makes these materials less attractive for acid amelioration.

Twenty-two lime samples have been analysed for neutralisation value and 18 other characteristics. Fifty lime samples were taken from all parts of the country to arrive at a general picture of the quality of the lime sources.

Agrohydrology

It was found at the Vaalharts Irrigation Scheme that the 42 % of the water from the Vaal River used as surface irrigation on the flood beds, the 10 % seepage losses from earth furrows and the 8 % losses from canals have given rise to a shallow water table. The groundwater supplied extra water but also additional mineral salts to the topsoil. It was possible to wash the salts out of 3 000 ha of brackish land by means of subsurface drainage systems, but at the expense of an increase from 6 % to 15 % in the drainage output from the amount of Vaal River water used.

The improvement of the flood systems and the use of the drainage water for irrigation are undergoing further investigation and the water and salt balance of the area is being monitored.

At the Loskop Irrigation Scheme the testing of research results from small experimental plots at the commercial farm level under sprinkler and centre pivot systems was started. On each of 10 farms irrigation of 1 ha of a crop (wheat + cotton) was managed with the aid of an evaporation pan, tensiometers or a computer model, while the rest of the crop grew under normal farm irrigation management. The water consumption and crop yields of the farm and the trial were then compared with the ideal water: yield curve for wheat. It is

expected that the management system used in the trial and farm management will be adjusted to obtain an improved commercial irrigation management system. Commercial water:yield curves for various crops will then be obtained. These curves will reflect the efficiency of water delivery at the farm sluice, water supply on the farm, water distribution among the crops and water supplementation in the soil, the water quota, the area of lands, the crop rotation and the care of crops against the background of the Loskop climate.

AGRICULTURAL METEOROLOGY

Agroclimate

Possible tea and coffee cultivation areas were indicated on 1:250 000 scale maps. New interpolation techniques for temperatures are being developed and a classification of wheat growing areas in the OFS is nearing completion. Data of about 5 000 rainfall stations have been fed into the agricultural meteorology data base. Further tests with automatic weather stations have been carried out and good results have been obtained.

Influence of the weather on crops

The study of the influence of the climate on the growth rate of maize has been completed and has produced illuminating results in respect of the phenology of maize. A very stable heat unit parameter has been developed. Mathematical models for simulating the growth and production of maize and natural grazing have undergone further refinement. The picking ripeness project for apples has reached an advanced stage and is producing excellent predictions.

Predictions

The technique study for the prediction of unfavourable weather conditions for the mohair industry has been continued and will possibly be operational next winter.

IRRIGATION PLANNING

During the year under review work on seven different projects continued, namely -

1. The Riet River Government Water Scheme
2. The Sterk River Government Water Scheme
3. The Pongola Water Scheme
4. The Sundays River Extension and Kinkelbos
5. Wit Els (George)
6. N'Kwaleni-Heatonville
7. Korente-Vette River

Under the Orange River project the report and inventory in respect of farm layout on the Sanddraai Development were finally completed.

SURVEYS AND DEMARCA-TIONS

Land type survey

The whole of the RSA is represented on 67 1:250 000 maps; two further maps show two small areas at Keimouth and Maclear. Seventeen land-type maps have been printed, field work has been completed on a further 23, field work is being carried out on 7 at present and no field work has been done on 22. The latter maps are situated in the Northern Transvaal, Dundee, Griqualand East, the Eastern Cape, the Karoo and the Citrusdal-Van Rhynsdorp areas. The intention is to have the first inventories, which will cover the Northern Cape and the Western Free State, published during 1981. The analytical programme is keeping pace with the field work.

Peri-urban soil surveys

The PWV area is covered by 21 1:50 000 sheets. No sheets have been published but the field work has been completed on 9 and is far advanced on 11. There are 37 1:50 000 sheets for the Western Cape. The field work on 6 has been completed and the field work on 4 is far advanced.

Detailed investigation of 18 552 ha and semi-detailed investigation of 377 440 ha have been carried out for irrigation development.

SOIL CONSERVATION RESEARCH

Rainfall simulators

During the year under review the value of the three rainfall simulators, purchased the previous year, became very evident.

Following the example of several researchers in the USA and other Western countries, several researchers and extension officers throughout the country used the simulators, on the one hand to determine soil properties and standards for various soil conditions with reference to erosion control and irrigation practices, and on the other hand as a visual demonstration aid for transmitting technology and extension.

In this way the simulators were used at at least 30 sites, including 12 in Natal, 3 in the winter rainfall area and a few on the Springbok Flats, the irrigation areas of the Free State and the maize fields of the Western Transvaal. Simulators were also used at a farmers' day at Morgenzon, at the agricultural high school.

Average soil losses from burnt plots at Cedara with virtually no surface cover were found to be nearly *seven times* the average soil loss from the non-burnt plots with cover varying from 8 to 87 %. Average percentage runoff was nearly *six times* greater.

The trials on the sloping pineapple fields of the Eastern Cape so strikingly illustrated the nature

of erosion that entirely new approaches to conservation measures followed.

The value of surface cover to prevent erosion and reduce run-off, whether in the form of plant cover or as a mulch on fields, is probably the most important factor that is underlined by the simulators in almost every case.

RESOURCE CONSERVATION

Key soil conservation works

Progress with the construction of key soil conservation works is shown in Table 1.

TABLE 1 - Works completed and under construction

Year under review	Construction of new works			
	Under construction Number	Value R	Completed Number	Value R
1979/80	10	406 230	10	595 503
Repair of works				
	Under construction Number	Value R	Completed Number	Value R
	1	3 000	18	112 394
Construction of new works				
	Under construction Number	Value R	Completed Number	Value R
1980/81	7	271 827	19	1 155 435
Repair of works				
	Under construction Number	Value R	Completed Number	Value R
	4	89 180	18	114 923

The data in the table are indicative of an increase in expenditure of 94 % for new works and 2,3 % for the repair of works.

From April 1968, when the Soil Conservation Works Subdivision was created at Aliwal North, to the end of the year under review an amount of R16 146 000 was spent on key soil conservation works. Of this amount, R9 520 000 was spent within the Upper Orange River catchment and the rest was spent in areas where key works were considered essential. The amount includes the cost of the repair and maintenance of works.

Soil conservation committees

Committees are not automatically established, as in the past, but are established only at the request of a community, expressed through Organised Agriculture. Although these new arrangements have meant that the farming community has gained a greater share and say in the establishment of local organisations, the response so far has been disappointing and requests for the establishment of only 91 committees have

been received, out of a possible number of about 300.

The majority of the 91 committees appointed by the Minister by the end of the year under review were in the Natal and Eastern Cape Regions.

Soil conservation subsidies

The type of soil conservation works erected and the amount paid in subsidies are reflected in Table 2.

TABLE 2 - Soil conservation works subsidised

	1979/80 R	1980/81 R
Inner camp fences	199 882	182 341
Stock watering systems	253 312	254 929
Erosion fences	30 686	36 977
Earth banks, weirs, spoil banks and distribution banks	441 849	655 217
Contour bank systems	911 732	831 464
Subsurface drainage works	431 735	481 712
Total	2 269 196	2 442 640

The slight increase in subsidies paid out during the year under review is ascribed mainly to the higher subsidy rates applicable since 1 October 1980 and not so much to an increase in interest in conservation measures.

Planning of farms

The number of farms planned during the year under review is reflected in Table 3.

TABLE 3 - Physical planning of farms

Region	New plans		Replanning	
	1979/80	1980/81	1979/80	1980/81
Highveld	281	197	247	183
Karoo	233	170	227	324
Natal	23	39	114	85
Eastern Cape	46	50	372	360
Transvaal	124	99	153	80
Free State	111	138	407	438
Winter Rainfall	66	43	272	228
Total	884	736	1 792	1 698

A notable decrease in the number of both new farm plans and farms that have been replanned is evident from Table 4. The large-scale flood disasters, especially in the Winter Rainfall and Karoo Regions, hampered the normal operations of the extension staff considerably, since large inputs were required for determining the extent of damage and providing extension on re-building.

Run-off control planning

During the year under review considerably fewer kilometres of waterways and contours were surveyed and subsidised than during the previous year. For instance, whereas in 1979/80 a total of 4 422 km was surveyed in the Highveld Region, the distance during the present year under review was

only 709 km. A shortage of staff is given as the main reason for this. In the Eastern Cape and Highveld Regions special attention is being given to suitable grasses for waterways.

Run-off control planning on pineapple fields remains a high priority issue in the Eastern Cape Region and a course on the planning and layout of these lands was presented to farmers by the East London Extension Office. Good progress was made with soil and slope classifications in the Border Subregion, 11 419 ha having been completely classified and mapped during the past year. This brings the area that has been classified and mapped to 19 519 ha, which constitutes 90,6 % of the pineapple area.

In the Winter Rainfall Region the building of waterways decreased by 20 %, but the subsidy in respect of waterways increased by 17 %. This larger subsidy may be ascribed to the higher rates payable. The total length of contour banks erected decreased by 38 %, chiefly because of the fact that grass waterways have to become thoroughly established before any contour banks can be staked off.

Regulatory control

The year under review marked the beginning of a new era for the inspection services of the Division of Soil Protection. The former soil protection inspectors were assigned to the various Regional organisations with effect from 1 April 1980 and the inspection services became a Regional function under the Soil Conservation Act. However, control under this Act remains in the hands of the Division of Soil Protection.

One conviction was obtained during the past year. From 1969 to 31 March 1981 a total of 36 prosecutions were instituted and 32 convictions followed.

As Table 4 shows, there are 130 farms to which directions apply at present.

TABLE 4 - Number of farms on which directions were served and withdrawn during the year under review

Region	Transferred from previous year	Added during year under review	Finalised during year under review	Number still in force
Highveld	11	1	0	12
Karoo	14	0	2	12
Natal	22	1	0	23
Eastern Cape	26	0	0	26
Transvaal	21	0	3	18
Free State	16	5	0	21
Winter Rainfall	18	2	2	18
Total	128	9	7	130

In addition to the service of the above directions on properties, a number of problem cases in each Region are regularly monitored. The table gives an indication of the situation in each Region.

TABLE 5 - Number of monitored farms where contraventions are suspected and cases dealt with during the year

Region	Carried over from previous year	Added during year	Finalised during year	Total cases pending
Highveld	187	37	42	182
Karoo	296	28	35	289
Natal	309	19	57	271
Eastern Cape	134	5	4	135
Transvaal	229	10	34	205
Free State	251	0	0	251
Winter Rainfall	266	54	53	267
Total	1 672	153	225	1 600

Subdivision of agricultural land

The application of the Subdivision of Agricultural Land Act, Act 70 of 1970, as amended, has meant that agricultural land cannot be subdivided into units that are too small.

The activities of the Division of Soil Protection in respect of this Act amount mainly to the handling of applications for the subdivision of agricultural land, the vesting of undivided shares, the expansion of areas of jurisdiction, long-term deeds of lease on portions of agricultural land and the registration of servitudes.

TABLE 6 - Applications for the subdivision of agricultural land

Period	Approvals		Rejections		Total
	Number	%	Number	%	
1971-01-02 to 1978-06-30	4 241	81	974	19	5 215
1978-07-01 to 1979-06-30	495	81	98	19	593
1979-07-01 to 1980-03-31	313	82	67	18	380
1980-04-01 to 1981-03-31	495	84	96	16	591
Total	5 544		1 235		6 779

During the year under review 591 applications were received, as against 380 during the previous period reviewed, which covered 9 months; the increase is 17 %. This increase can probably be ascribed to the economic revival. The fact that the percentage of approvals increased from 82 % to 84 % indicates that the standard of the applications received is more in line with the requirements of the Department.

Permission to subdivide agricultural land necessarily means an increase in the number of farms. On the other hand an attempt is being made to consolidate smaller units in order to create more viable units. The present situation, which has resulted from the application of Act 70 of 1970, is shown in Table 6.

During the year under review the number of new farm units created increased by only 51, as against the 58 of the previous period reviewed, which covered 9 months. This represents a decrease of 34 % over the previous period reviewed. This

TABLE 7 - Number of farm units created and number of farms and area of farms consolidated with other properties

Period	New farm units created	Consolidations	
		Number of farms	Area (hectares)
1971-01-02 to 1978-06-30	1 057	2 981	1 261 018
1978-07-01 to 1979-06-30	110	377	170 479
1979-07-01 to 1980-03-31	58	213	94 361
1980-04-01 to 1981-03-31	51	308	110 988
Total	1 276	3 879	1 636 846

trend is also evident, although to a lesser degree, in the number of units that disappeared as a result of consolidation (8 %). A total of 1 276 new units have been created since 1971. However, during the year under review 308 small unviable units disappeared as a result of consolidation. 3 879 of these small unviable units have disappeared since 1971.

Subdivision of agricultural land for non-agricultural purposes

In Table 8 the applications for subdivision for non-agricultural purposes are divided into two groups, namely:

- (i) Application for extensive occupation, business purposes, resorts and mining operations; and
- (ii) applications for intensive urban use.

During the year under review there were 91 applications for extensive occupation, trade, resorts and mining, which is 26 less than the 117 of the previous period reviewed, which extended over 9 months. Of the 91 applications, 38 or 42 % were rejected, as against 74 % during the previous period reviewed.

The area approved, namely 1 244 ha, is 18 % larger than the area approved during the previous period reviewed, which extended over 9 months. This increase can probably be ascribed to the economic revival. The fact that the number of rejections decreased by 49 is indicative of a far better knowledge by the applicants of the requirements they have to meet.

With regard to intensive use, the table indicates that 102 applications were received for the year under review, as against 97 for the previous

period reviewed. The area involved is 5 320 ha, as against 6 099 ha for the previous period reviewed. Out of the total area of the Republic and SWA of 196 869 000 ha, 185 364 ha or an average of almost 20 000 ha per year has been set aside for intensive occupation since 1971.

OPEN-CAST MINING

The exploitation of the Republic's rich mineral resources has meant that more and more agricultural land is being affected by mining operations. This applies especially to the high potential agronomic areas of the Transvaal Region, where the coalmining industry is developing rapidly.

This competition of the mining industry with agriculture led to the appointment of an Advisory Committee on Open-cast Mining to advise the Minister of Mineral and Energy Matters on the steps to be taken to restrict the harmful influence of open-cast mining on agricultural land to the minimum.

This committee visited several open-cast mines during the past financial year to inform them about the situation and so formulate a policy in respect of rehabilitation programmes.

Very good results are obtained with rehabilitation by the larger mining groups. However, the cost attached to the effective reclamation of mined areas is enormously high - R18 199 per ha on average. Attempts by the smaller mining groups are therefore necessarily less successful.

WEED CONTROL

During the past year the Department made good progress with establishing a weeds policy and an organisation to control invader plants and declared weeds, which constitute a growing and increasingly serious problem in the Republic.

The National Weeds Work Group was established to co-ordinate weed control. The task assigned to this work group includes close co-operation, planning and consultation between the various regional organisations, the Division of Soil Protection, the Plant Protection Research Institute, and more specifically the newly formed Weeds, Pesticides and Weedkillers Subdivision, the

TABLE 8 - Application for subdivision for non-agricultural purposes

Period	(i) Extensive occupation, business purposes, resorts, mining operations						(ii) Intensive urban use					
	Approved			Rejections			Approved			Rejections		
	No.	%	ha	No.	%	ha	No.	%	ha	No.	%	ha
71-01-02 to 78-06-30	633	50	23 124	634	50	41 630	482	93	119 078	36	7	6 083
78-07-01 to 79-06-30	52	57	752	39	43	1 369	48	100	54 867	0	0	0
79-07-01 to 80-03-31	30	26	790	87	74	798	97	100	6 099	0	0	0
80-04-01 to 81-03-31	53	58	1 244	38	42	462	87	85	5 320	15	15	2 569
Total	768		25 910	798		44 259	714		185 364	51		8 652

Department of Environment Affairs and the farming community.

No plants were declared weeds during the year under review, although applications were received for the declaration of *Argemone subfusiformis* (bloudissel), *Acacia mearnsii* (black wattle), *Salsola kali* (tumbleweed), *Acacia saligna* (Port Jackson) and *Acacia cyclops* (rooikrans).

Weed control is a nuisance to the community; it occasionally involves great expense without any notable return, which is why the application of the relevant legislation is essential and serves as an important aid in weed control campaigns. Two court cases were finalised in the Winter Rainfall Region, three are pending and the Division is engaged in preparing one case.

Jointed cactus

The campaign against this declared weed is continuing. Despite the sustained spraying programme in the course of which R13 million (119 million litres of spray) has been spent on spray since 1957, there is as yet no question of complete control.

Table 9 contains a summary of the jointed cactus situation in the Eastern Cape and Karoo Regions during the years 1964, 1980 and 1981.

TABLE 9 - Jointed cactus infestations and effectiveness of control in the Eastern Cape and Karoo Regions: 30 June 1964 to March 1981

Year	Size of properties (ha)	Infested veld (ha)	Infested veld under control (ha)	Number of owners/occupiers
June 1964	1 212 157	643 719	394 196	1 159
		53 %	61 %	
March 1980	1 705 590	838 996	633 211	1 717
		49 %	75 %	
March 1981	1 695 286	831 053	641 517	1 672
		49 %	77 %	

Although the area of new infestations has increased from 643 719 ha in June 1964 to 831 053 ha in March 1981, the area of infested veld under control has increased from 61 % to 77 % for the same period. In the Eastern Cape and Karoo Regions new infestations constitute 831 053 ha of a total area (properties) of 1 695 286 ha (49 %) and in the Natal Region 7 665 ha of new infestations were

found on 51 000 ha (15 %) of farm areas. New infestations are still continuously being traced.

Jointed cactus research (chemical and biological control)

According to results obtained between July 1979 and December 1980, the weedkiller MSMA in aqueous solution at dosages of 1:10 and 1:15 produced the best results. Major cost saving will result from the use of MSMA in that paraffin as a solvent will be replaced with water. Mixtures of MSMA and 245 - TP were also promising and may be used against jointed cactus in future, which will mean a further cost saving.

Studies on the insects *Cactoblastis cactorum*, *Dactylopius austrinus*, *Tucumania tapiacola* and *Mimorista pulchellalis* were carried out and suitable insects are still being sought overseas.

Nassella

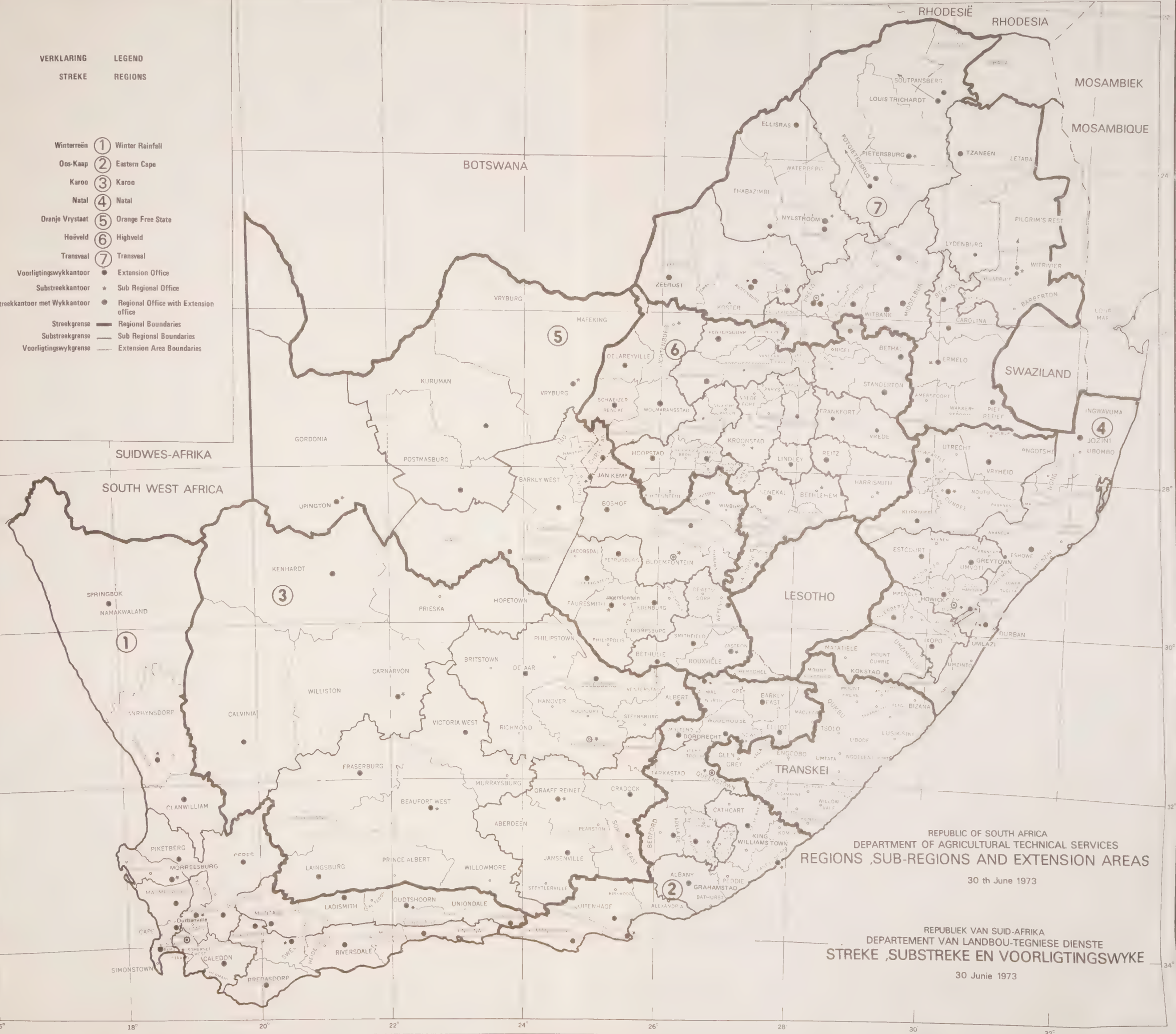
The campaign against *Nassella tussock* *Stipa trichotoma* is being energetically waged in the Eastern Cape, Karoo and Winter Rainfall Regions. As far as is known, an infested area of 59 613 ha occurs on 113 farms (126 352 ha) in the Eastern Cape Region. (A farm is classified as infested on the strength of a single plant).

Heavy infestations were confined to the District of Barkly East (3 farms with 155 ha), Cathcart (14 farms with 1 312 ha) and Wodehouse (1 farm with 345 ha). At Bosberg in the Karoo Region a heavy infestation of 3 000 ha has occurred, but a major portion of this is already under control. The average cost of chopping down the weed is R91,35 per ha, and the average spraying costs amount to R124,67 per ha.

Nassella occurs in several localities in the Winter Rainfall Region, namely in the foothills of the Langeberg, west of Swellendam, on 18 farms where the infested area amounts to about 220 ha, 39 ha of which is heavily infested. These heavy infestations have been reduced to an area of about 3 ha with the aid of the farmers. The infestation at Devil's Peak (Cape Town) covers about 450 ha and is being controlled by the Department of Community Development, using a team of 20 labourers. An infestation at Banhoek near Stellenbosch was recently reported.

VERKLARING LEGEND
STREKE REGIONS

- Winterreën ① Winter Rainfall
Oos-Kaap ② Eastern Cape
Karoo ③ Karoo
Natal ④ Natal
Oranje Vrystaat ⑤ Orange Free State
Hoëveld ⑥ Highveld
Transvaal ⑦ Transvaal
Voorligtingswykkantoor ● Extension Office
Substreekkantoor ★ Sub Regional Office
Streekkantoor met Wykkantoor ● Regional Office with Extension office
Streekgrense ——— Regional Boundaries
Substreekgrense ——— Sub Regional Boundaries
Voorligtingswykgrense ——— Extension Area Boundaries



REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES
REGIONS, SUB-REGIONS AND EXTENSION AREAS

30 th June 1973

REPUBLIEK VAN SUID-AFRIKA
DEPARTEMENT VAN LANDBOU-TEGNIËSE DIENSTE
STREKE, SUBSTREKE EN VOORLIGTINGSWYKE

30 Junie 1973

13. Entrepreneur development

AGRICULTURAL EXTENSION SERVICES

The seven regional organisations of the Department, namely the Transvaal, Natal, Eastern Cape, Winter Rainfall, Karoo, Free State and Highveld regional organisations, are responsible for passing on the latest developments in agricultural technology to the farmer. The demarcation of the Regions is indicated on an accompanying map.

GROUP ACTIVITIES

The dissemination of agricultural technology is undertaken mainly by the extension staff of each Region, using means such as programmed and *ad hoc* group extension work. Table 1 shows the scope of these activities during the past year.

It is clear from Table 1 that more inputs are made within the programme context than outside the programme context. It is also clear that *ad hoc* contacts with farmers show higher attendance figures and a larger number of collaborators than contacts within the programme context (16 356 as against 15 380). This shows that despite constant efforts to programme extension services there is a stream of *ad hoc* requests for services that nevertheless have to be rendered.

The corresponding statistics for the previous year (1979/80) show that as many as 17 860 *ad hoc* contacts were made as against the 11 937 "programmed" contacts. An unmistakable trend in favour of programmed extension work was therefore evident during the past year.

The most obvious explanation for this is the decrease in the number of extension staff, which makes a programmed working method essential so that the best use can be made of the available staff.

Table 2 shows the number of programme planning committees and study groups and the subjects and branches of farming catered for in this manner.

Table 2 shows that 265 active study groups with a membership of 2 914 were functioning in the seven regional organisations during the year under review. The most important subjects dealt with were economics, agronomy and pastures. In comparison with the previous year there was not much change.

With regard to the utilisation of study groups as programme planning committees, the number increased from only 9 during 1979/80 to 39 during the past year. Only 92 soil conservation committees were used as programme planning committees this year, as against 134 last year. The number of members involved also decreased from 967 (1979/1980) to 607 (1980/1981).

EXTENSION PROGRAMMES

The method of work known as programmed extension is employed in order to utilise available staff as effectively as possible.

The above-mentioned group activities may be regarded as a base from which the more formal extension programmes can be launched.

Table 3 reflects the scope and the extent of the impact of extension programmes within the seven regional organisations.

TABLE 1 - Programmed and *ad hoc* extension inputs by Regional organisations

Activity	Number		Total attendance figure or number of collaborators		Number of lectures delivered by extension staff	
	*P	*A	*P	*A	*P	*A
(a) Farmers' days held	59	155	4 132	7 435	66	130
(b) Courses presented for farmers	54	33	1 018	865	242	62
(c) Demonstrations held	70	70	645	1 093	33	35
(d) Study group meetings	558	290	4 658	2 658	419	98
(e) Soil conservation committee meetings	108	256	708	1 897	46	60
(f) Exhibitions held by extension staff	12	4	613	885	7	0
(g) Farming competitions held	39	26	285	221	2	0
(h) Meetings arranged with regard to (g)	21	5	900	235	20	3
(i) Co-operative trials/demonstrations	107	72	103	33	17	0
(j) Meetings arranged with regard to (i)	54	33	1 091	799	44	16
(k) Practical studies (yield standards and production techniques) in progress: (l)	272	73	674	104	16	2
(l) Meetings arranged with regard to (k)	218	12	553	131	10	4
Total	1 572	1 029	15 380	16 356	922	410

*P activities that appeared in the work calendar of an extension programme

*A *ad hoc* activities that did not form part of the work calendar of a programme

TABLE 2 - Application of programme planning committees and study groups

Subject Activity	Number of active study groups	Total number of members	Number of active study groups acting as programme planning committees	Soil conservation committees acting as programme planning committees	Number of members	Other programme planning committees	Number of members
				Number		Number	
(i) Pastures	30	324	3	13	85		
(ii) Beef cattle	7	99	1	2	3		
(iii) Dairy cattle	5	48	0	0	0		
(iv) Sheep	7	51	2	3	27		
(v) Other livestock	4	47	0	0	0		
(vi) Soil	18	263	3	2	19		
(vii) Irrigation	9	108	1	5	29		
(viii) Horticulture	11	140	2	0	0		
(ix) Agronomy	67	876	19	8	70	4	28
(x) Economics	94	800	4	92	8	0	0
(xi) Soil conservation	5	60	3	57	361	3	24
(xii) Other	8	98	1	1	5	4	24
Total	265	2 914	39	92	607	11	76

TABLE 3 - Scope of extension programmes in the seven regional organisations

	Programmes with in fairly homogeneous areas ¹	Programmes aimed at target audiences ²
Number of areas with programmes	48	45
Area involved (ha)	3 445 288	4 516 839
Number of farmers involved	5 062	8 416
Area of land or veld mapped during year under review (ha)	Land 96 344 Veld 12 088	Land 11 419

¹For the purposes of this report fairly homogeneous areas are taken to be target areas, priority areas and development areas which are fairly homogeneous and for which development or run-off control plans have been drawn up and are being applied

²For the purposes of this report a target audience is taken to be a specific group of farmers to whom a particular message of common interest is directed but who do not live within a particular homogeneous area (e.g. dairy, pig or chicken farmers in a district(s)).

According to Table 3 almost 13 000 farmers were served through formal programmed extension in the shape of 93 programmes presented within fairly homogeneous areas or target audience areas over a total of almost 8 million ha.

The principal achievements of the extension programmes include the following:

Winter Rainfall Region

Viticultural programmes

Since viticulture is one of the chief branches of farming in the Montagu and Ladismith wards, the extension effort is directed at the improvement of cultural practices.

In the Ladismith ward, where weed and pest control were identified as problems, it was found that persuasion programmes contributed to the fact that 70 % of the wine and table grape farmers now follow a weed-killer programme and 80 % apply satisfactory disease control.

Karoo Region

Demarcation of fairly homogeneous farming areas

The identification of vegetation formation classes within land types on an area of about 29,0

million ha in order to place the demarcation of fairly homogeneous farming areas on a more scientific basis has been completed. This means that about 13,5 million ha was dealt with during the past year, which is an achievement in view of the fact that normal extension work had to be done at the same time.

Durum wheat growing

In brief, the following were the successes achieved with the promotion of Durum wheat production:

- Seed sales increased by 65,2 per cent.
- The area planted doubled, reaching 900 ha.
- The total yield of 2 603 tons was 72 per cent higher than the previous year (1979/1980).

Highveld Region

Withdrawal of low-potential soils from cultivation

Progress with programmed extension is reflected by the improved production practices applied by members of study groups. This is especially applicable to the following production techniques, which received attention:

- The withdrawal of low-potential soils from cash crop cultivation;
- choice of crop and cultivar according to soil potential;
- balanced fertilising according to soil potential.

A case study on the farm Lammermoor, belonging to Mr Johan de Kock of Grootvlei, which provides a typical example, is shown in Table 4.

The data in Table 4 show that after the withdrawal of low-potential soils and a slight increase in fertiliser costs, grain production *doubled* and income over fertiliser costs increased by 160 %. In the Bethlehem extension ward 102 farmers, from a total of about 700 farmers, were involved in 10 active study groups. Eight soil classification courses in which farmers were persuaded to play an active part in the classification of their own farms were presented. Each course lasted three days.

Eastern Cape

Protection of pineapple fields

Very good progress was made with the programme aimed at persuading farmers to protect pineapple fields at East London and Komga. Of the 21 535 ha of land in the area, 11 419 ha has now been classified and mapped. A positive change of attitude is discernible among the community concerned, and among communities involved in the programme concerning the correct utilisation of State and major soil conservation works at Aliwal North, Dordrecht, Molteno and Queenstown.

Establishment of dryland lucerne

In the Queenstown extension ward the programme aimed at the establishment of more lucerne is progressing very satisfactorily. Only 7 % of the dry lands per farm in the Queenstown magisterial district were under dryland lucerne in 1976/77. The figure is now 11,5 %. At Sterkstroom lucerne was established on only 1,1 % of land in 1976/77, and this has now increased to 31 %. On irrigated lands at Queenstown the corresponding area under lucerne in 1976/77 was 11,8 %; it is now 48,2 %.

THE COLLECTION OF DATA ON YIELD STANDARDS AND PRODUCTION TECHNIQUES

The regional organisations are responsible for directing agricultural development according to the

principles of optimum land use. If this challenging task is to be performed, yield standards for crop and animal products have to be established, and the appropriate production techniques determined. Although basic research inputs are necessary and form the core of this knowledge, research results from a few experimental plots cannot be held up to farmers as universally applicable. Soil and climatic conditions in particular areas often differ dramatically from those in the research situation.

Consequently the extension service is required to make a contribution in this field as well.

Information on yield levels and production techniques is obtained from farmer collaborators according to a scientifically based method.

Yield standards and practical studies in the Free State Region

For several years the Free State Region has taken the lead and made a valuable contribution here.

Table 5 shows the scope and extent of impact of these activities in the Free State Region.

The Free State Region reports that owing to a shortage of manpower there was a decline in the number of collaborators and studies undertaken this year. Only 187 collaborators could be dealt with this year, as against 248 last year. The results obtained from the studies are not only an outstanding aid in the extension task and an important educational opportunity for young officers, but also make a big contribution to the establishment of standards and guidelines and the identification of urgent farming problems that require further research.

The following are a few interesting observations that arose from the yield standard and production technique studies:

Small stock

For the second successive year yield figures with regard to Boer goats have emphasised the enormous meat potential of this browser, which, at 1,6 lambs/ewe/year, produces 22 kg of meat.

Wheat under irrigation at Vaalharts

The following aspects emerged from the 1980 planting and harvesting season:

- A maximum yield of 7,727 tons/ha was obtained with flood irrigation.
- Potassium fertilising could not be shown to be correlated with higher yields. The highest

TABLE 4 - A case study on the farm "Lammermoor": Withdrawal of low-potential soils from cash crop cultivation

Year	Total yield		Fertiliser costs		Total income		Area cultivated		Income less fertiliser costs	
	Tons	Index	Rand (1)	Index	Rand (2)	Index	Ha (3)	Index	Rand (2)-(1) (3)	Index
1977/78	525	100	12 216	100	70 321	100	267	100	218	100
1978/79	678	129	16 054	131	77 938	111	237	89	261	120
1979/80	677	204	14 392	118	132 588	189	209	78	566	260

yield was realised on soil with the lowest potassium status.

(iii) During the 1980 planting and harvesting season 26 blocks of wheat were evaluated and a study in respect of the cultivars revealed the following:

Cultivar	Yield
Saragoza	7,002 tons/ha
T4R	6,137 tons/ha
T 4	6,068 tons/ha
SST3	4,567 tons/ha

It appears from the study that Saragoza has a higher potential than T4 or T4R, but is not as adaptable in respect of planting time as T4 or T4R. This aspect is important because wheat sometimes has to be planted after cotton, during the second half of June.

(iv) Although research has determined that the optimum level for nitrogen application is 90 - 110 kg of N/ha, far higher applications are found in practice. A yield of 7,72 tons/ha was obtained with a nitrogen application of 137 kg of N/ha.

(v) Observations in respect of irrigation indicate that irrigation is a critical factor in obtaining a yield of over 7 tons/ha - especially during the flowering stage. Studies indicate that right from the flowering stage it is necessary to irrigate as soon as 60 - mm of water has evaporated from a class A pan.

Centre pivot irrigation

During the past four seasons valuable information has been collected in the course of this project. The most important norms are given in Table 6.

It appears from the study that groundnuts in particular do very well under mechanical overhead irrigation, with a crop factor of 0,6 and an irrigation precipitation of 30 mm per ha. If the

precipitation exceeds 30 mm, run-off is obtained, whereas an application of less than 30 mm reduces the efficiency of water utilisation.

FARMING TRENDS

Winter Rainfall Region

The Winter Rainfall Region has experienced a period of great extremes in respect of rainfall during the past year. While the Eastern areas were struck by catastrophic floods the North-western areas and especially Bushmanland were in the grip of an unprecedented drought, which has prevailed since 1977.

In the Little Karoo hail damage, the disaster floods and continuous rain reduced grape and fruit production by between 20 and 50 per cent. Furthermore, flood damage and the preceding drought in this subregion, where over 90 % of the Republic's lucerne seed is produced, caused such crop failures that shortages were experienced throughout the country.

In the South Coast Subregion the planting period for small grain was dry and unfavourable and heavy rains during harvesting caused further major losses. A number of farmers at George lost their entire grain crop as a result of late rains and the quality of grain in the rest of the subregion was reduced. At Caledon, for instance, 4,5 % of the wheat crop was undergrade. Table 7 shows the reduced wheat, barley and oat crops of the past season in the most important districts of the Southern Cape.

Karoo Region

- The total scheduled areas under irrigation were increased from 15 539 ha to 23 176 ha through new and revised water allocations along the Teebus, Brak, Great Fish and Little Fish rivers. Irrigation farming is therefore becoming more important in the Districts of Middelburg, Hofmeyr, Cradock and Somerset East.

TABLE 6 - Information in respect of yield and production techniques for wheat, groundnuts, wheat and maize. (Sishen)

Production techniques and miscellaneous factors			Crops and data	
	Wheat	Groundnuts	Wheat	Maize
1. Area (ha)	80	100	180	180
2. Planting date	11-07-78	3-6 Dec. 1978	12-23 June 1979	22-25 Dec. 1979
3. Cultivar	T4	Sellie	T4	PNR 432
4. Plants/ha	860 ears/m ²	270 000	-	45 500
5. Fertilising kg/ha N	148	98	187	201
Fertilising kg/ha P	100	75	48	80
Fertilising kg/ha K	22	13	32	401
6. Irrigation/ha	790 mm	694 mm	702 mm	600 mm
7. Crop factor	0,6	0,6	0,55	0,5
8. Espacement	180 mm	44 x 7 cm	180 mm	86 x 15 cm
9. Seed/ha	100 kg	100 kg	105 kg	26,3 kg
10. Harvesting date	11-12-78	22-04-20-05-79	10-20 Dec.	15 July 1980
11. Growing season (days)	150	147	142	-
12. Previous crop	Veld	Veld	Groundnuts	Wheat
13. Yield				
Seed, tons/ha	6,83	3,53	6,85	7,0
Straw, tons/ha	3,3	3,3	3,13	-
14. Gross margin	472	-	-	-

TABLE 7 - Percentage comparison of grain crops during 1980/1981 and 1979/1980

Ward	Wheat		Barley		Oats	
	79/80	80/81	79/80	80/81	79/80	80/81
Riversdale	+ 108	- 50	- 43	- 73	+ 66	- 95
Swellendam	+ 47	- 40	- 5	- 78	- 29	- 82
Caledon	+ 24	- 20	- 35	- 50	- 13	- 55
Bredasdorp	+ 4	- 25	+ 17	- 52	+ 9	- 52
George	+ 48	- 40				
Mossel Bay		- 11				
Subregion average	+ 46	- 31	- 16,5	- 63	+ 8	- 71

- The turnover of land-owners with accompanying unrealistically high land prices (from the point of view of production) continued during the past year. The result is that higher and higher financial demands are being made on certain farming units and as a result the potential is being notably reduced by incorrect management.
- At least 140 farms (27 % of the total) in the Magisterial Districts of Jansenville and Steytleville changed ownership during the past eight years. Although the registered owners decreased by 47 (11 per cent), as many as 90 new farmers have entered the profession since 1972. This had a marked rejuvenating effect, since the new farmers included 43 sons who had taken up farming in partnership with their fathers. The new farmers were generally young and satisfactorily trained - an encouraging trend.

Highveld Region

The following trends were experienced:

- The interest of farmers in soil potential as the basis for the choice of crops and fertilising practices is increasing.
- The acceptance of minimum soil cultivation practices as a counter to high fuel prices.
- The greater inclusion of the stock factor in field husbandry areas - especially on low potential field husbandry soils.
- Greater interest in beef farming at the expense of dairy farming in particular.
- The poor condition of the natural pastures and the virtually complete absence of pasture management measures.
- The refinement of standards, with a view to optimum crop production and pasture management.
- An extension strategy to reach the middle group of farmers through programmed action.
- The control of weeds and plant diseases on maize lands where stubble cultivation is applied.

Transvaal Region

The following trends were encountered:

- An increase in the area under maize cultivation in the South-Eastern Transvaal

and an increase in yields as a result of improved cultural practices.

- There is still a tendency towards larger plantings of almost all types of citrus and subtropical fruit in the Eastern Transvaal Lowveld. Avocados and bananas are being planted, especially in the Tzaneen ward, and there is a considerable amount of interest in guavas throughout, and less interest in kiwi fruit.
- Seed maize is being cultivated on a fairly large scale in the Komatipoort area, after a long interval.
- Maize production in the North-Western Transvaal is increasing at the expense of wheat production as a result of crater disease in wheat.
- In the Koster grain area farmers are switching to 90 cm rows for maize, as against 2 metre and "railway track" rows.
- An increase in sunflower production and maize production at the expense of dryland wheat is being experienced in the northern part of the Western Transvaal Subregion.
- There has also been an increase in soya-bean production, with denser espacement under dryland conditions.
- Grain sorghum cultivation is replacing dryland wheat in the turf areas. Yields of as much as 7 tons per ha were obtained, with an average of 5 tons per ha, during the past season. Dryland cotton production in this area appears very promising and research on this subject should be undertaken again.
- Farmers in the Brits area are starting to move away from tobacco farming. Many farmers use sprinkler irrigation. During 1980/81 fifty-eight applications were referred to the Western Transvaal Subregion for the necessary soil investigations and for reporting on sprinkler irrigation systems.
- Avocado plantings expanded considerably during the year under review. The more favourable economic situation for beef production resulted in farmers paying more attention to stock management practices and taking more interest in pasture control practices and the establishment of artificial pastures.

Natal Region

The following trends were encountered:

- Increasing interest in maize cultivation, in terms of both larger plantings and improved management practices, with a consequent increase in yield per ha.
- As a result of the higher meat prices, there has also been increasing interest in the production of beef on artificial pastures, using a fattening system.
- An improved price structure resulted in larger plantings of lucerne for commercial hay

production in the Weenen and Muden irrigation areas.

- Over the past 15 years there has been a continuous tendency among farmers in Northern Natal to plough additional land each year and so enlarge the area under maize. This trend is expected to continue.
- There is increasing interest among farmers in stubble cultivation (minimum tillage) owing to the higher fuel prices. The recent drought had the effect of increasing interest in the supplementary irrigation of maize.
- A swing to maize production, with an increase of as much as 20 %, is being encountered in some areas. The economic upswing in beef prices resulted in renewed interest in weaner calf sales.
- Increasing interest is being shown in avocado pears for export purposes in the coastal areas. The drought of the past year was a motivating factor, but interest also increased after the installation of additional irrigation facilities over the past two years - especially with a view to cultivating subtropical fruit.

Eastern Cape Region

The following trends are being encountered:

- The mohair industry is still on a very sound footing. However, after record prices had been obtained there was a sharp drop in the price of mohair.
- As a result of the profitability of the mohair industry, land prices have rocketed to a level that could possibly be unhealthy. Consequently Angora goats are being run outside their accepted ecological area.
- The advantageous mutton prices and relatively smaller profit margin from beef farming, together with the relatively more serious effect of drought on beef cattle, have resulted in a wider sheep: beef cattle ratio in the grassveld areas. A combination of the above factors has also led to a visible deterioration in the condition of the veld in certain areas.
- In the Uitenhage area the stock factor is increasingly being included in grain farming, and promising results are being obtained with a high grazing pressure on artificial legume pastures. The high production costs attached to grain farming as the sole enterprise could be considerably reduced in this way.

PROBLEMS IN AGRICULTURAL PRODUCTION

Winter Rainfall Region

- Sporadic droughts are characteristic of the weather pattern of the extensive grazing areas of the region and these, in combination with inadequate management techniques, lead to progressive deterioration of the veld cover,

which is already sparse. Putting a long-term drought-aid plan into operation as an alternative to the present financial aid measures for feeding animals could help bring greater stability to the agricultural industry.

- Since large areas of the natural veld no longer have the inherent potential to improve under conventional management practices, grazing research to provide techniques for radical veld improvement should receive far higher priority.
- The provision of services is seriously hampered by vacancies. This may even be a good thing, in that the farming community only realise how much extension means to them when a vacancy arises.

Karoo Region

The following matters are considered important:

- In the extension programmes launched it is important to persuade farmers to -
 - (i) apply optimum veld utilisation practices
 - (ii) plant drought feed crops on a large scale
 - (iii) follow improved stock management practices
 - (iv) make financial management through record-keeping a practical reality
- Lack of research on the following matters is causing difficulty:
 - The profitability of grazing systems
 - The burning of veld and the treatment of burnt veld
 - Biomass determinations of the most important trees and shrubs in the Noorsveld
 - The effective use of Sweet Noors *Euphorbia coerulescens* as a drought or tactical feed source

Highveld Region

Serious staff shortages have meant that important areas of work could not receive the necessary attention. As a result of numerous *ad hoc* tasks which are delegated to the extension service from time to time, the limited staff cannot meet the demands of programmed extension.

Transvaal Region

The following are regarded as serious problems:

- A severe shortage of specialists to support the ward extension officer.
- Services on an *ad hoc* basis for other Government departments, such as soil investigations and irrigation reports for the Department of Water Affairs, Forestry and Environmental Conservation take up about 49,3 % of the extension staff's time.
- A deficiency of information on the control of stalk and root diseases of wheat and maize and the control of Russian wheat aphid.

- Past and present uncertainty about the consolidation of lands, which has prevented farmers from embarking on new practices that involve higher costs.

Natal Region

The following problems are being encountered in agricultural production in the Natal Region:

- There is an urgent necessity for determining soil potential in East Griqualand.
- Sufficient extension on cotton cultivation is not being undertaken.
- Farmers are not willing to plough up productive sugar-cane in order to apply strip cultivation.
- The uncertainty about the future of the Alfred district has resulted in a decline in interest in development planning. Cattle farmers tend to turn to speculation instead of breeding.

The following research areas require attention:

Natal Midlands

- Yield standards in respect of pastures and crop cultivation under irrigation on an ecotopic basis.
- Effective weed control with minimum and stubble cultivation in maize production.
- The practical production of high quality grass silage.

Northern Natal

- A method of establishing the carrying capacity of veld under various veld management systems.
- Maize cultivation techniques with special reference to minimum cultivation techniques in respect of various soil types and weed problems.
- Grazing research - there is a need to test various artificial pastures and to determine production curves.

Coastal Subregion

- Veld management on game farms and game reserves should receive attention.
- Meteorological information on moisture conservation methods with regard to dryland cotton cultivation should receive attention.
- The correct use of goats and fire to control bush should be given attention.

Eastern Cape

The following problems were encountered:

- There is still a lack of information on yield standards and production techniques and this should be rectified through extension in the near future.
- The Region does not yet have land type maps and there is also a serious shortage of funds and manpower.

- With regard to the deficiency of information on standards and production techniques, further research through field trials is required to establish the yield potential of various cultivars and crops, such as maize, wheat and potatoes, under particular resource situations.

TRAINING AT COLLEGES OF AGRICULTURE

Training at colleges of agriculture is made available to prospective farmers at five colleges of agriculture, viz Elsenburg (Stellenbosch), Grootfontein (Middelburg - Cape), Glen (Bloemfontein), Potchefstroom and Cedara (Pietermaritzburg).

Table 8 gives information on student numbers.

TABLE 8 - Student numbers at colleges of agriculture

College	Student numbers	
	1980/1981	1979/1980
Stellenbosch (Elsenburg)	155	156
Grootfontein	96	83
Glen	130	122
Potchefstroom	129	135
Cedara	154	139
	664	635

SHORT COURSES

In addition to formal college training for farmers, various short courses are presented at colleges of agriculture. Particulars are given in Table 9.

TABLE 9 - Short courses presented at colleges of agriculture - 1980/1981

Subject	Number of courses	Number of participants
Sheep and wool	14	403
Angora goats and mohair	2	105
Dairy farming and dairying	15	591
Pigs	1	120
Beef farming	2	187
Artificial insemination	1	20
Feed planning	3	34
Grain grading	8	275
Soil classification	6	90
Mechanisation/ welding	2	27
Vegetables	2	99
Grain silo operation	1	60
	79	2 320

AGRICULTURAL INFORMATION SERVICES

POPULAR PUBLICATIONS

During the year under review 237 new

leaflets were prepared and printed by the Publications Section. The joint impression of all the leaflets in both official languages came to 2015 000 copies which were distributed to farmers and other interested parties according to a computerised mailing list.

The leaflet service is now well established with 66 series, most of which are complete and are kept up to date by means of continual revision. To supply in the sustained demand for leaflets, series are continually supplemented with reprints.

One-hundred-and-sixty-two leaflets of 24 subjects were reprinted during the course of the year.

The publishing and distribution of newsletters, reports of the Department's overseas offices, manuals and other reports continued throughout the year.

SCIENTIFIC PUBLICATIONS

Agroplantae, Agroanimalia, Agrochemophysica, Phytophylactica

During the year under review 80 articles (67 English and 13 Afrikaans) were received - four articles less than during the previous 9-month report. Together with a carry-over of 82 articles, 162 articles were dealt with. Of these, 73 (60 English and 13 Afrikaans) were approved, 57 (44 English and 13 Afrikaans) are still under consideration, 24 (18 English and six Afrikaans) were rejected, seven (five English and two Afrikaans) were scrapped and one (English) withdrawn.

Of the 73 approved articles, 71 (57 English and 14 Afrikaans) were published, while two English articles are being carried over. The year under review therefore ended with a carry-over of two approved articles and 57 still under consideration. Of these 59 articles (46 English and 13 Afrikaans) one was received during 1978/79, seven during 1979/80 and 52 during 1980/81. Both approved articles date from 1980/81.

Onderstepoort Journal of Veterinary Research

The following editions appeared during the year under review and were compiled as follows:

Volume 47(2) with 10 contributions

Volume 47(3) with 10 contributions

Volume 47(4) with 12 contributions

Volume 48(1) with 9 contributions, so that 41 contributions were published.

Up to 31 March 1981, 41 articles were received. On 31 March 1981 the position was as follows:

Carried over from the previous year - nine.

Received from 1980-04-01 to 1981-03-31 - 42.

Of these 51 articles, 41 have already been published and 10 are being carried over.

Other Scientific Publications

The following scientific publications appeared from 1 April 1980 to 31 March 1981. Entomology Memoirs No. 53; Technical Communication No. 167, 168, 169, 170, 172 and 173; Botanical Survey Memoirs No. 45 and 46; Scientific Bulletin No. 395; Flowering Plants of Africa Vol. 46 parts 1 and 2; Bothalia Vol. 13 (1 and 2); Flora of Southern Africa Vol. 10 part 1 and Vol. 27 part 4.

AGRICULTURAL NEWS

Agricultural News went from strength to strength during the year under review and its worth as an important news medium again became obvious.

Both the rural press and weekly agricultural journals are making increasing use of reports in the newsletter. Many reports that initially appeared in Agricultural News served as a stimulus for subsequent SABC talks or articles in women's magazines. In addition, reports regularly appeared in the agricultural press.

Although Agricultural News is not specifically aimed at the farming community as such, many farmers, agro-chemical and other companies concerned with farming frequently ask to be included in the mailing list - further proof of the newsletter's impact.

It is the aim of the editorial staff to further improve this newsletter and to keep it as "lively" as possible. More often than in the past, the staff members were on the look-out for success stories of farmers who work in close co-operation with the Department - study groups in particular - and to make these stories known.

The many achievements of the Department's researchers were again given prominence, extension hints were published and speeches and statements by the Minister and Deputy Minister were published regularly so as to present an objective image of the Department and of agriculture.

Researchers, extension officers and other officers as well as employees of private agricultural companies make increasing use of Agricultural News as a source of information.

The newsletter was also authoritatively quoted by leader farmers at the major agricultural congresses held during the past year.

The editorial staff continues to pay meticulous care to the contents, typography and lay-out so as to keep the newsletter up to the highest standard.

Reports concerning virtually all activities and achievements of the Department of Agriculture and Fisheries were collected and published.

CALLING ALL FARMERS

The service continued to favour matters of topical interest during the past year. A special effort was made, as far as research was concerned, to broadcast information at the stage of the season when it could be best utilised by the farmer.

Agricultural commodity control boards and other departments were also more closely involved and at present, the Wool Board, Meat Board and Dairy Control Board regularly contribute to the programme while other boards and departments contribute sporadically.

Because of the steadily increasing demand for protein sources information about the cultivation of protein rich crops such as groundnuts and sunflower seed was concentrated upon.

Particularly successful were series of talks concerning financial management on the farm, coloured agriculture, training and health care of farm workers as well as a series of talks on smallstock diseases.

Visits to farms, where the principles of optimal resource utilisation are successfully put into practice, remain an important source of outstanding radio material.

UDIO-VISUAL SERVICES

Thirty-seven new slide series were completed, duplicated and furnished with commentaries on magnetic tape during the year under review. This number includes six short programs on achievements in agriculture and these were screened during the Republic Festival RSA 20 in Durban.

Duplicate sets of 303 programs went out on loan and 60 programs were issued on a permanent basis to extension offices, research institutes and Divisions of the Department. From all accounts these programs are being put to excellent use in training actions. Various Universities, Colleges of Agriculture and Agriculture Co-operatives also had slide series duplicated for their own use.

At the request of SARCCUS a practical course in slide-making was offered to six Black delegates from Malawi, Swaziland, Botswana and Lesotho.

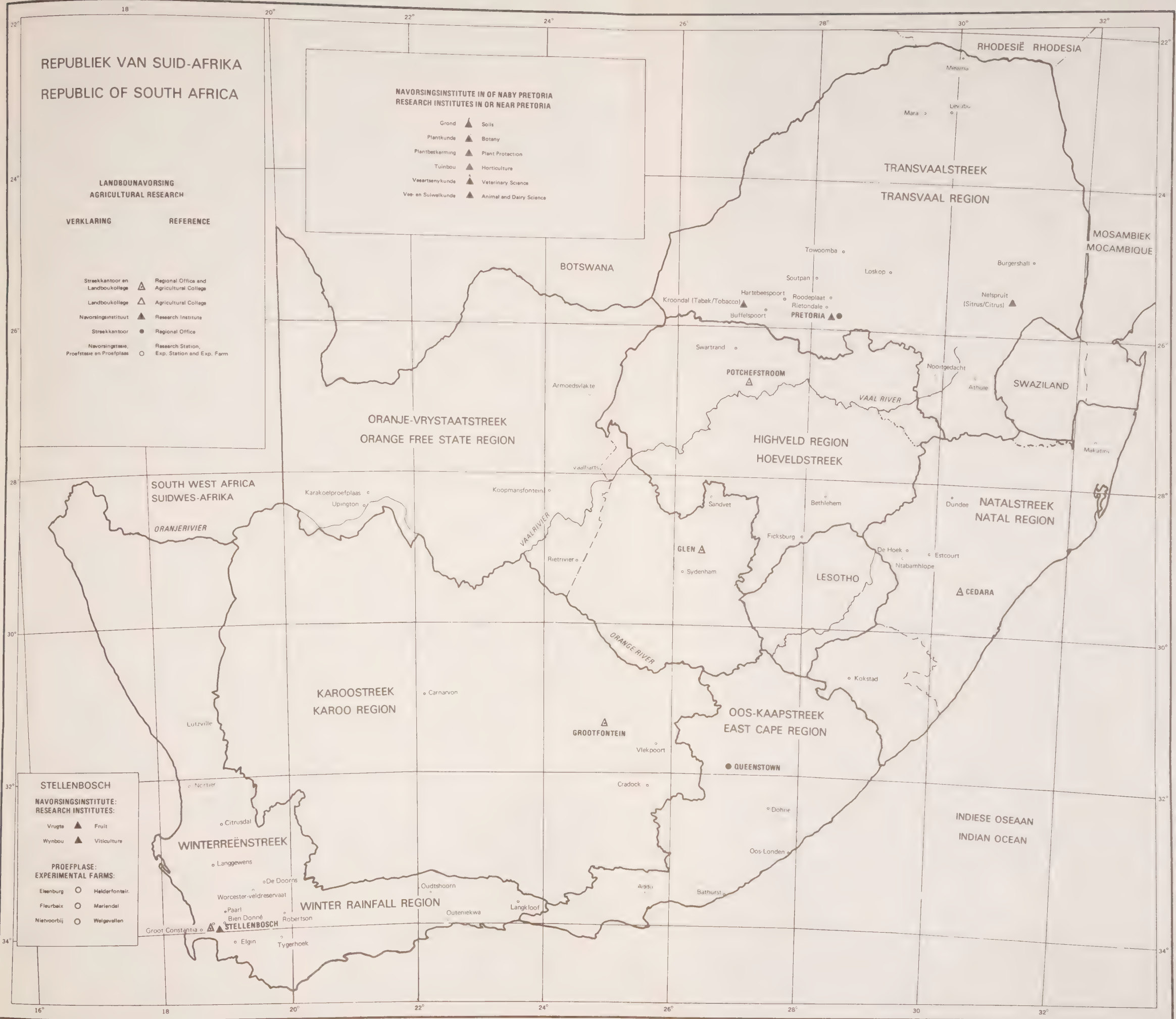
AGRICULTURAL LIBRARIES

In an attempt to provide a better service for research workers of the Department of Agriculture and Fisheries two special aspects are receiving attention.

The first is the SOUTH AFRICAN DOCUMENTATION CENTRE FOR AGRICULTURAL INFORMATION (SADAL). Magnetic tapes are on order from the COMMONWEALTH AGRICULTURAL BUREAUX and a number has already been received. The Division of Agricultural Information has already started retrieving literature for research workers. As soon as the system is fully operational the library will be incorporated.

Since numerous sources are being brought to the attention of research workers in this manner, the development of a balanced book stock is the second aspect under consideration. This is the function of a subcommittee of SADAL and the Central Agricultural Library has already started eliminating unnecessary duplication of periodicals. Simultaneously the libraries of the Divisions/Regions/Institutes are being further developed to include material required to cover the projects in their specialised fields.

All the branch libraries were visited during the year and on the whole there were few problems.



REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

LANDBOONAVORSING
AGRICULTURAL RESEARCH

VERKLARING

REFERENCE

- | | |
|---|--|
| Streekkantoor en Landboukollege | Regional Office and Agricultural College |
| Landboukollege | Agricultural College |
| Navorsingsinstituut | Research Institute |
| Streekkantoor | Regional Office |
| Navorsingsstasie, Proefstasie en Proefplaas | Research Station, Exp. Station and Exp. Farm |

NAVORSINGSINSTITUUT IN OF NABY PRETORIA
RESEARCH INSTITUTES IN OR NEAR PRETORIA

- | | |
|---------------------|--------------------------|
| Grond | Soils |
| Plantkunde | Botany |
| Plantbeskerming | Plant Protection |
| Tuinbou | Horticulture |
| Veerstermykunde | Veterinary Science |
| Vee- en Suivelkunde | Animal and Dairy Science |

ORANJE-VRYSTAATSTREEK
ORANGE FREE STATE REGION

SOUTH WEST AFRICA
SUIDWES-AFRIKA

ORANJERIVIER

KAROOSTREEK
KAROO REGION

STELLENBOSCH

NAVORSINGSINSTITUUT:
RESEARCH INSTITUTES:

- | | |
|--------|-------------|
| Vrugte | Fruit |
| Wynbou | Viticulture |

PROEFPLAAS:
EXPERIMENTAL FARMS:

- | | |
|-------------|---------------|
| Elenburg | Heiderfontein |
| Fleurbaix | Mariendal |
| Nietvoorbij | Welgevallen |

WINTERREËNSTREEK

WINTER RAINFALL REGION

GROOTFONTEIN

OOS-KAAPSTREEK
EAST CAPE REGION

QUEENSTOWN

INDIESE OSEAAN
INDIAN OCEAN

TRANSVAALSTREEK

TRANSVAAL REGION

MOSAMBIEK
MOCAMBIQUE

SWAZILAND

NATALSTREEK
NATAL REGION

HIGHVELD REGION
HOEVELDSTREEK

GLEN

LESOTHO

CEDARA

14. Supporting services

BOTANICAL RESEARCH

Progress with the important Flora of Southern Africa project has been satisfactory, in spite of the limited manpower available. Particularly gratifying was the progress with taxonomic research on the mosses, pteridophytes and fossil plants.

As in past years the publication effort of the Institute was substantial; a total of 95 individual publications appeared. Apart from scientific publications, pamphlets on 18 of the most important waterweeds were published in both Afrikaans and English. The National Weeds List comprising some 1600 species will be published shortly.

Two important ecological projects were started, namely a survey of the Transvaal forest and a study of 35 Cape estuaries.

FLORA RESEARCH

Flora of Southern Africa

Two works were sent to press: (1) an introductory volume entitled *Botanical Exploration in Southern Africa*, and (2) Part 1, fascicle 1, of a

volume on mosses.

Manuscripts for the following volumes or fascicles thereof were received by the editor: Vol. 4: Xyridaceae-Juncaceae; Vol. 7: Iridaceae (*Romulea*, *Syringodea*); Vol. 18: *Kirkia* (Simaroubaceae), *Triaspis* and *Acridocarpus* (Malpighiaceae); Pteridophyta: *Cheilanthes* and others totalling 180 of the 250 species.

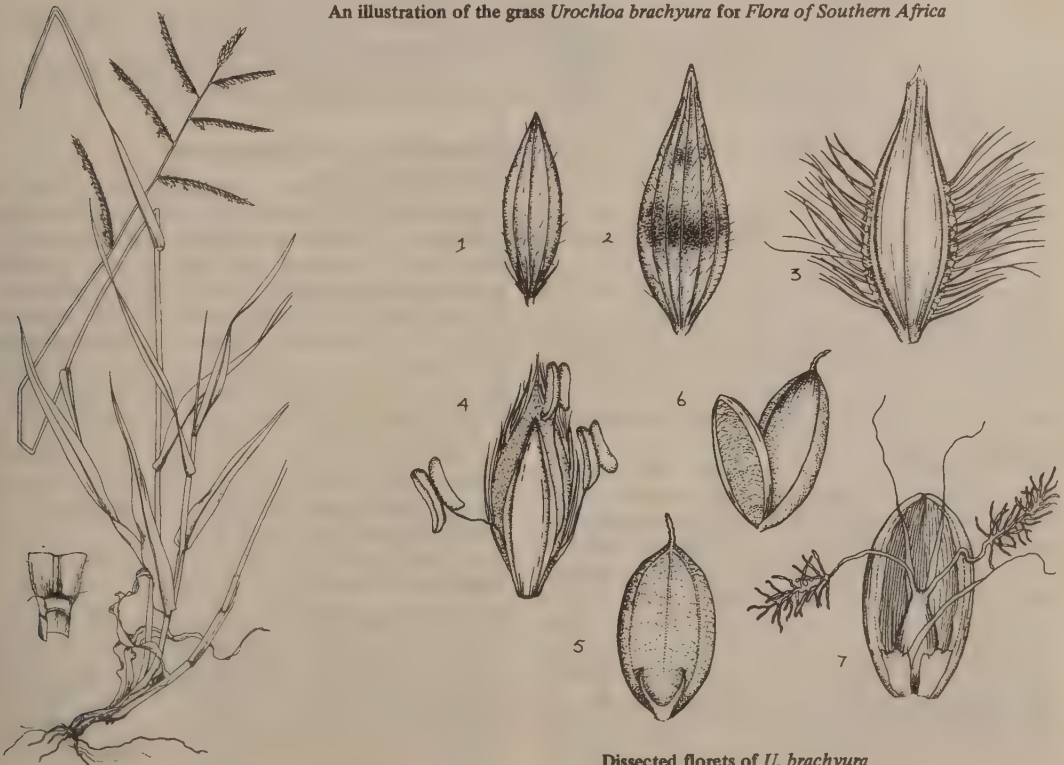
Staff members made good progress with the following volumes: Vol. 2: Foaceae; Vol. 4: Restionaceae; Vol. 5: Liliaceae; Vol. 8: Orchidaceae; Vol. 10: Polygonaceae; Vol. 11: Mesembryanthemaceae; Vol. 16,3: Papilionoideae; Vol. 25: Ericaceae; Vol. 32: Campanulaceae.

Palaeoflora of Southern Africa

Nearly 2000 newly collected specimens were catalogued and added to the Institute's Molteno collection, which now totals almost 7000. These collections led to significant improvements being made to the revision of the genus *Dicroidium*, which is being prepared for the Palaeoflora.

A review of genera of megaplants of the Permo-Triassic, which is being produced at the

An illustration of the grass *Urochloa brachyura* for *Flora of Southern Africa*



Dissected florets of *U. brachyura*

Institute with the co-operation of 30 experts from all parts of the world, has progressed well.

Register of plant taxonomic projects

The register was updated with the aid of a questionnaire sent out in collaboration with the secretariat of AETFAT (l'Association pour l'étude taxonomique de la flore d'Afrique tropicale).

Southern African Plants - waterweeds

In the series *Southern African Plants* pamphlets on 18 of the most important waterweeds (with colour illustrations) were published in both English and Afrikaans. The text comprises a short, image-creating description in non-technical language and paragraphs on related species, distribution, dispersal, ecology, importance, legislation, control and the origin of the name. A distribution map and a literature list complete each brochure. Species dealt with include kariba weed *Salvinia molesta* and parrot's feather *Myriophyllum aquaticum*.

Pretoria Flora

Keys and descriptions of 680 species belonging to 49 families were finalised and typed. Family descriptions were designed to be, as far as possible, image-creating and diagnostic. A key to all tree species, based on vegetative characters, was largely completed.

Ceropegia and related genera

A fully illustrated account of the genera *Ceropegia*, *Riocreuxia* and *Brachystelma* with many distribution maps was sent for publication. It covers the same basic ground as Vol. 27,4 of the Flora of Southern Africa but was written for both the amateur and the botanist.

Leguminosae

Considerable progress has been made in defining the species limits of *Psoralea* in South Africa. Types of most species have now been traced. Detailed descriptions of 18 species of *Psoralea* and *Otholobium* have been written up for publication.

PLANT STRUCTURE AND FUNCTION

Grass leaf anatomy

Grasses from the more tropical parts of South Africa were concentrated on and collecting trips undertaken to Zululand, the Kalahari and the Kruger National Park. Many rare and poorly known grasses were found and studied anatomically. The results indicate that several of these grasses may be incorrectly classified and that their evolutionary relationships are not reflected in the present classification. Further work on the taxonomy of these species will be carried out before final decisions can be made.

Grass identification for herbivore food preference studies

The purpose of this study is the quantification of the diet of grazing herbivores. Initially factors that affect this quantification will be examined. For this purpose representative samples of three widespread grass species (*Themeda triandra*, *Brachiaria serrata*, *Eragrostis capensis*) have been collected at different localities in South Africa. Different anatomical epidermal characteristics as well as differences in digestibility, that may be influenced by environmental factors, are being examined in these species.

Cytogenetics of *Eragrostis curvula*

A short study has been carried out to determine whether a correlation exists between the surface area of the stomatal complexes and the chromosome number in *Eragrostis curvula*. It was found that an increase in chromosome number is positively correlated with an increase in stomatal surface area. This implies that this method of measuring stomatal areas can be applied to the identification of diploid *E. curvula* plants, which are rare, sexually reproducing plants that are essential for any breeding programme that may be contemplated.

PLANT EXPLORATION

Conservation of germ plasm

During the year 87 collections were made of primitive crop plants:

Lagenaria - 33, collected mainly in Zululand and Gazankulu; *Sorghum* and

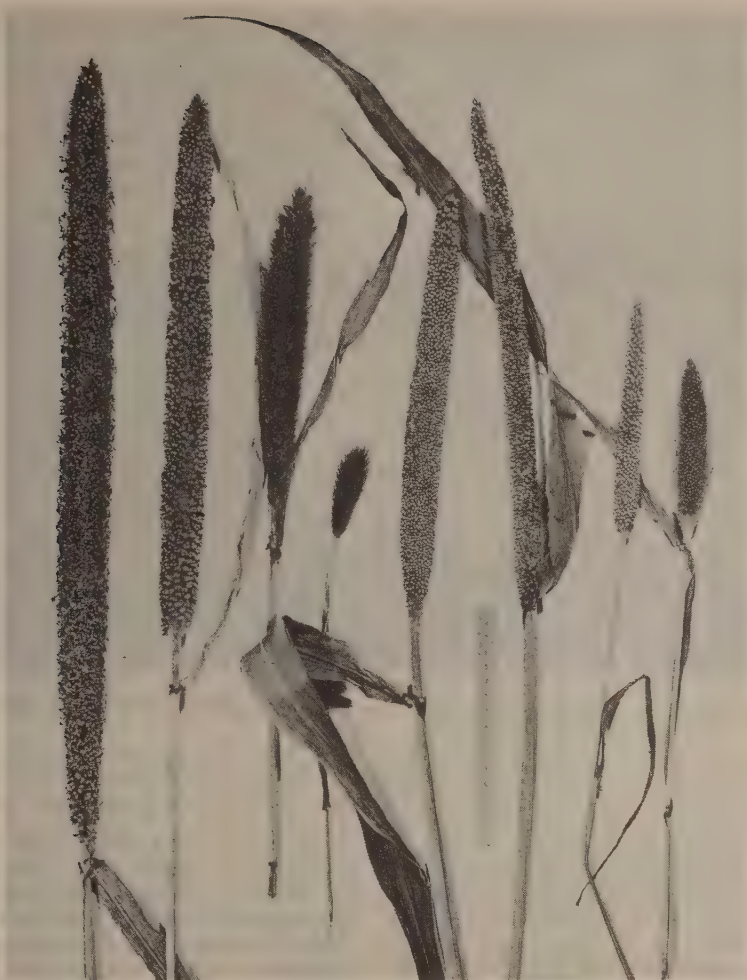
Pennisetum 11; *Citrullus* - 5; pulse crops - 10 and miscellaneous - 19.

Conservation of threatened plants

The rare and endangered plants of the Transvaal (216 taxa) were examined and the compilation of dossiers for each taxon started. On the basis of a list of taxa in the National Herbarium represented by five or fewer collections, an additional $\pm$ 480 were added to the threatened plants list, increasing the total to approximately 2395 taxa. Threatened plants growing in the BRI gardens and nursery were also listed. These include 40 families, 113 genera and 260 species. Of these, 3 taxa are considered to be extinct in the wild, namely *Encephalartos woodii*, *Leucadendron concarvum* and *Elephantorrhiza woodii*. Fourteen taxa are endangered, 50 vulnerable, 106 rare and 37 with undertermined status.

Origin and classification of sorghum

Approximately 100 specimens of primitive crop sorghums collected throughout South Africa have been examined, and identified to the level of variety and, in some instances, forma. Forty-one collections, many from elsewhere in Africa, were obtained from the Department's seed bank and



Pennisetum americanum subsp. *americanum* race *typhoides* (Pearl Millet); inflorescence forms collected from a single cultivated field

have been grown. A review of archaeological literature relating to *Sorghum* in South Africa has revealed that recent carbon datings of *Sorghum* seed suggest that this crop probably arrived in South Africa 700 years earlier than was originally estimated, namely about 1 700 BP (about 200 AD).

Origin and classification of *Pennisetum*

Work on the primitive crop *Pennisetum* has shown that the cultivated members of this genus are extremely variable. In some parts of the country it is often difficult to find two inflorescences from a single field that look alike. Despite this, most of the material examined appears to belong to *Pennisetum americanum* subsp. *americanum* race *typhoides* (cultivated form). A limited number of specimens was identified as belonging to *P. americanum* subsp. *stenostachyum* (weedy form). Club-shaped inflorescence forms reported not to exist in South Africa have been collected from various localities.

Two new morphological characters not mentioned in existing literature were discovered.

Ethnobotany

In the wood utilisation study involving the Tsonga of Gazankulu, 192 bundles of firewood were weighed and analysed. The most important species used are *Colophospermum mopane* and *Combretum apiculatum*, representing 41% and 21% of the total firewood weight recorded. Mopane also comprises 90% of the wood utilised in hut and granary construction.

During a period of six months 87 huts were built in the study area of three villages. Each hut requires 30-46 poles, which means that between 2610 - 4002 poles taken from up to 270 trees were used.

Tree distribution in the Transvaal

The basic field work towards establishing high resolution distribution maps for each of the 900 indigenous woody species of the Transvaal has



Scaevola thunbergii and introduced *Ammophila arenaria* colonising pioneer dune at Keurbooms River mouth

progressed significantly: a further 174 of the $\frac{1}{16}$ degree square units have been sampled, so completing this Institute's sampling contribution. Two significant additions to the proposed format of the final report include enhancement of the autecological element and the inclusion of line drawings for each species.

Barrier plants

Progress on this project has been good. A further approximately 30 species have been added to the existing security barrier list, bringing the total to 230 species. One hundred different taxa have been collected on field trips, either as whole plants or as cuttings, and their growth and establishment closely followed. Similarly, seed germination tests have been carried out on 20 taxa.

Information services

Our Scientific Information Officer handled 477 requests for information about economic plants and their utilisation or control. Numerous visitors (1897), including Science Olympiad winners, overseas visitors, scholars and members of the public, were taken on special tours of the Institute and its gardens and nursery.

National weeds list

The basic weeds list now includes the names of some 1 600 species. A weed classification system has also been devised. This classification system

covers the origin, habitat, kinds of weeds, weedy characteristics, useful characteristics, life cycle, reproduction, growth form and woodiness (in addition to a taxonomic classification and common names). To date about 1 200 species have been classified.

Lantana camara

Thirty taxa have been written up and photographed. Each taxon has been assigned a uninomial, e.g. sheba, baxa, jubula, quagga, etc. Preliminary field keys have been compiled for all the yellow-and-orange-flowered taxa, and tested in the field. The remaining keys and taxa will be completed in 1981/82. Flowers, fruits, stems and leaves of four taxa have been surveyed with the SEM and show taxonomically significant differences.

Rubus

Material of *Rubus* housed in various greenhouses within the Botanical Research Institute has been repotted, fertilised, relabelled and placed in a central shade house. Specimens have been photographed and prepared for examination using the scanning-electron microscope.

Nasella tussock

The investigation into the longevity of *Nasella* tussock has been shelved until all autecological work currently undertaken by officers in the

Western Cape and Winter Rainfall Regions has been completed.

Woody invaders

In the Transvaal 41 of the $\frac{1}{4}$ degree squares in the survey area have been sampled. Of these 31 % were completed this year. Forty-eight species, including five additions to the list, have been recorded. Of these 12 are considered to the particularly aggressive and invasive.

GOVERNMENT HERBARIA

Information

Altogether 22 434 plant specimens were identified for officers of the Institute, various Government Departments and provincial administrations, universities, the public and neighbouring states. The four herbaria dealt with 1 758 visitors who requested information on a wide range of subjects.

Development

The collections of the four herbaria were increased during the year by 20 513 specimens. Several expeditions were undertaken for this purpose.

Lack of records of plant species from the Orange Free State and Northern Karoo caused the Institute to collect extensively in the area after the good late rains.

Research

Taxonomic research by staff of the herbaria is continuing as a contribution towards the Flora of Southern Africa. The groups being investigated are Bryales (mosses), Ericaceae, Polygonaceae and Campanulaceae. A start has been made on groups in the Leguminosae and Cyperaceae.

The seed and fruit collection is now being worked on and increased. Work has begun on the recording of all seed and fruit types in South Africa with the aim of producing a guide.

BOTANICAL GARDEN

In all 1 420 accessions, including 606 research accessions of material of *Lantana*, *Lagenaria*, *Sorghum* and other genera, were received, classified and catalogued during the year. The area surrounding the new dams was landscaped. Road construction continued and normal replacement plantings of annuals and shrubs were made in the garden. Five hundred and eighty-eight trees were transplanted from the nursery to the six biomes.

ECOLOGY

Veld types of South Africa

Further progress on the revision of the veld types of the western half of the country is being made as a co-operative venture. That part of the

revised treatment of the Kalahari Thornveld that remains to be completed awaits the completion of the revision of the Veld Types of the Northern Cape, on which considerable progress is being made.

Transvaal bushveld survey

Field work on the plant ecology of the farm Groothoek, Thabazimbi district, has been completed. The vegetation has been classified into 21 communities and variations of communities. The condition of the vegetation has also been assessed. The synthesis of community, habitat and assessment data is reflected in a single table that was prepared by a new set of computed programmes developed for this purpose.

Transvaal forest survey

Preparatory work on a transect study of the Sabie area is well under way, aerial photographic interpretation and stratification for stratified random sampling having been completed. Field sampling has commenced.

KwaZulu coastal dune survey

Field work for the project 'Vegetation study of the Zululand coastal dunes between Richards Bay and Mlalazi Lagoon' was completed. Specimens have been collected and vegetation recorded from about 120 sites. Areas important for conservation were found mainly along the coast, near to the Mlalazi River Mouth and the vicinity of the new Richards Bay Mouth.

Studies of littoral vegetation

In a special study of the coastal vegetation opposite St Croix Island near Port Elizabeth five major vegetation categories were recognised. Further work is being done for the book on dry coastal ecosystems of the world. A section has been prepared on the dune vegetation of the east coast of South Africa. Meanwhile, work on the western and southern Cape coast is nearing completion. This phytosociological study, confined to the special vegetation that comes under the direct and strong influence of the sea and the maritime climate, revealed a series of five major plant communities from wet to dry, along the southern Cape coast. Analysis of data previously collected along the western Cape coast showed that the strand vegetation can be divided into the Capensis and the Namaqualand Floristic Regions, with the Olifants River Mouth as boundary.

Studies of Cape estuaries

A botanical survey of the 138 Cape estuaries between the Orange and Kei Rivers was started in September 1980. The vegetation of 35 estuaries has been mapped from colour aerial photographs and, for 11 of these, the mapping units have been

checked and their species composition, structure and environmental conditions studied.

Aquatic ecology

Field and laboratory data collected on the growth rate and chemical composition of water hyacinth plants have been synthesised and a final report is nearing completion. Growth coefficients determined in culture compare favourably with those determined for various species of diatoms and algae. Growth rates in the field are considerably higher than those in culture, but are influenced by the growth form of plants, atmospheric conditions and nutritional factors. Provided lower growth rates determined in culture are compensated for, growth coefficients generated in culture do predict growth rates measured in the field.

The increase of reeds *Phragmites australis* from 1937 to 1976 in the Siyai Lagoon in Natal was studied with the aid of aerial photographs. The reeds increased from 0,27 ha in 1937 to 2,94 ha in 1976.

Cape fynbos survey

Western Cape foreland studies

A preliminary vegetation map of the western foreland between the Berg River Mouth and False Bay has been drawn; it shows the boundaries of the Strandveld, Coastal Fynbos and Coastal Renosterbosveld types at a scale of 1: 250 000. These veld types were subdivided into twelve smaller categories. Some alterations were made to the accepted veld type boundaries, particularly near Saldanha Bay and the Cape Flats.

By 1972 agriculture, urbanisation and the spread of introduced weeds had reduced the former extent of Strandveld, Coastal Fynbos and Coastal Renosterbosveld, south of the Berg River, to 41 %, 14 % and 6 % respectively. Only 0,2 % of the original extent of Strandveld in the Western foreland has been conserved, and only 0,01 % of Coastal Fynbos and of Coastal Renosterbosveld. Thus there is a very urgent need to preserve remnants of these veld types.

Cape mountain fynbos studies

The field sampling and data processing have been completed and will be used to set up a structural-functional classification of mountain fynbos, which is much needed by managers and researchers working in this vegetation. A classification has been developed and tested in the field and is now being finalised. Several papers are being prepared on various aspects of this work.

Orothamnus zeyheri (marsh rose)

Observations over an extended period have revealed that marsh rose populations show cyclical fluctuations in size depending on the length of the inter-fire interval. The longer the interval, the fewer the number of remaining plants. This species could

survive a fire-free period of 34 years, although a fifteen-year period would probably be optimal.

Frequent fires, excessive trampling and an increase of infestations of *Phytophthora cinnamomi* or other lethal fungi could endanger the survival of this montane species.

Fynbos biome project

One aspect of this study was to examine the vegetation of the Fynbos Biome Project study site at Pella. Eight communities were identified and a preliminary map was drawn. The final map, together with a systematic checklist of the flora, will be completed when further identifications are received.

NAKOR National Plan for Nature Conservation

The Botanical Research Institute continued to co-ordinate the NAKOR National Plan for Nature Conservation for the Department of Environment Affairs. The latter Department will henceforth provide the services of a full-time co-ordinator, and the Institute will provide the technical support necessary to manage the data bank and related operations.

Other environmental planning work

A report was prepared on a vegetation survey of the P160-1 highway corridor, which is intended to pass through the Magaliesberg and Witwatersrand ranges. In this report the possible impact of the highway on the surrounding vegetation was discussed and recommendations made as to how this could possibly be minimised. On the basis of an aerial photographic interpretation and information received from the Saasveld Forestry Research Station, recommendations were made for the setting aside of natural areas for the George Guide Plan, which is being prepared by the Environmental Conservation Section of the Department of Environment Affairs.

South African Savanna Ecosystem Project: Determination of the seasonal biomass change of the dominant woody species

Attention has been given to important departures from the normal sigmoidal growth pattern in shoots of selected woody plants. Early season growth fluctuations could be ascribed largely to asynchronous growth of shoot populations as well as to the dependence on different conversions to shoot mass through time. Shoot growth was also affected significantly by plant size and the branched status of the twigs. Root studies of savanna plants showed that the hitherto unknown rate of root tip loss was fairly constant during the growing season but attained a maximum in autumn and winter.

PUBLICATIONS

Publications by members of the Institute continued to appear at the same rate. Seventy-one individual scientific and twenty-four popular articles were published during the year. Bothalia 13, 1 & 2, running to 262 pages, appeared in print, as did Flowering Plants of Africa and Blomplante van Afrika 46, 1 & 2. Two Memoirs of the Botanical Survey of South Africa were published, namely No. 45, *The Plant Ecology of the Isipingo Beach Area, South Africa*, by C.J. Ward and No. 46, *A Phytosociological Study of the Upper Orange Valley* by M.J.A. Werger.

PLANT PROTECTION RESEARCH

NATIONAL COLLECTION OF INSECTS

Specialised taxonomic studies

Parasitic Hymenoptera

Work is continuing on the Encyrtidae and Aphelinidae. Accessions, comprising series of parasites of which the hosts and host plants are known, now total 6300. Accessions of other chalcidoid families for which biological data are known now total 370. A large amount of new and important material was collected by Dr Naser of this Institute, during his search for natural enemies of the black scale, *Saissetia oleae*.

A large number of identifications were undertaken for research workers involved in biological control studies in South Africa and in countries such as Reunion, Kenya, the Republic of Senegal, the Ivory Coast, Japan, Australia, Israel, Greece and the USA.

Four taxonomic studies on the Chalcidoidea were published during the year and another four are now in press. The published works include a study on the genus *Metaphycus*, which attacks soft scale insects, a study of the genus *Prococophagus*, which includes some important parasites of the black scale, and an illustrated guide to the families of the Chalcidoidea. This latter publication is the first of its kind on the African fauna.

Bruchidae (seed beetles)

A project entitled "A taxonomic study of the Bruchidae that attack the indigenous *Acacia* species" was completed during the past year. Thirty-seven *Acacia* species produced thirty named and several unnamed bruchid species. Biological observations in connection with oviposition, larval development, pupae and adults were recorded. Sketches of the male genitals and antenna of Bruchidae and distribution maps of the *Acacia* species were completed.

Anthophoridae (carpenter bees)

The taxonomic revision of the large carpenter bees is nearing completion. The males and females of all 22 Southern African species have been associated, redescribed and illustrated. About 100 new accessions, collected in the Western Transvaal and Zululand, have been added to the collection.

The remainder of the aculeate Hymenoptera collection has been expanded by the addition of some 2000 new accessions. This part of the collection has also been curated according to the most recent acceptable classification.

A manuscript on mortality in natural populations of carpenter bees is being prepared for publication. The available data on parasitism, predation and mortality caused most probably by weather has indicated that these factors alone are not sufficient to explain the regulation of carpenter bee populations in the field. It is thought that mortality of the pre-reproductive adult bees and occasional heavy predation are largely responsible for population regulation.

Isoptera (termites)

Routine determinations of 415 termite series were made during the period under review; these included determinations of samples submitted by the public and certain organisations. The annual increment of termites to the national Collection of Insects amounted to 305 series, of which 222 were collected in South Africa and 83 in other African territories by overseas scientists. As at 30 June, 1981, the National Collection of Insects contained 33 793 termite series, which are conservatively estimated to contain more than 1,5 million specimens.

Two termite/termitophile surveys, both of which were centred on the *Odontotermes* complex, were conducted in the Cape Province. The gross yield was 222 series of Isoptera including 139 colony samples of *Odontotermes* of which more than 98% were complete with all fertile and sterile castes. The 85 *Odontotermes* nests that were excavated and searched yielded 4022 specimens in 165 series of termitophiles, 37 specimens in 3 series of physogastric phoridae (Diptera) and the balance Coleoptera. The staphylinid beetle genus *Termitodiscus*, the species of which are all host-specific, was recovered from all 85 *Odontotermes* nests. When named, these *Termitodiscus* species will provide a far more accurate determination of the termite host species than the conventional study of morphological characters.

Four illustrated pamphlets for inclusion in a forestry series were compiled and papers on the fossilised nests of Hodotermitidae and the identification of the genus *Bifiditermes* were published.

Field trips undertaken to Entabeni Forest Reserve, Thabazimbi, Zululand and the Eastern Transvaal resulted in the collection of over 1000 specimens of Neuroptera, 737 of which have already been curated into the National Collection. The Neuroptera collection now stands at 4136 specimens, including 2290 Myrmeleontidae and 1107 Nemopteridae. Collections of other economically important families have expanded considerably, especially collections of the Chrysopidae, Hemerobiidae and Mantispidae.

Studies on the Myrmeleontidae and Nemopteridae were continued and two publications resulted from this work with another two currently in press.

Tephritidae (fruit flies)

The taxonomic revision of the Dacinae is almost complete. Scanning electron microscope pictures have been taken to check errors of previous workers and to examine certain aspects of the morphology of the Dacinae. The recent *Catalogue of African Diptera* published by the British Museum has been studied and all current bibliographies included in this revision.

Dipterists from Zimbabwe and Switzerland visited the unit during 1980 to obtain information and the loan of tephritid material for studies in progress in their countries.

GENERAL COLLECTION OF INSECTS

Field trips were undertaken to the following areas to collect insects for the National Collection: Entabeni Forest Reserve, Thabazimbi, Loskopdam area and the Eastern Transvaal. Several short excursions were also undertaken to areas near Pretoria. During the course of these trips, several thousand specimens were obtained, representing 11 orders and about 50 families. The majority of the material has been curated and incorporated into the National Collection. Accessions, which include biological data, now total 8500. During the year several additional holotypes were deposited in the Collection, bringing the holotype collection to 920.

Two new professional officers joined the staff and will conduct taxonomic studies on snout-beetles and aphids. The new aphid collection already comprises some 200 series, for which host plant data has been recorded.

The identification service of the General Collection continues to be in great demand. During the past year, 120 identification jobs were completed, including more than 1000 individual determinations. These determinations were carried out for research workers, extension officers and the general public. Great difficulties are being experienced in identifying certain groups of insects owing to the lack of local specialists, so that the expertise of overseas taxonomists has to be sought.

CHEMICAL CONTROL OF INSECTS

Pesticide dynamics

An investigation into the incidence of pesticide residues in birds and fish was completed during this year. It was found that pesticides with a long residual period are present in almost all organisms. The use of these pesticides has already been banned in South Africa and the low concentrations found will be further reduced in future.

Several research projects concerned with the residual action of pesticides on cabbage, cotton, grain sorghum, stored grain and dairy products were successfully completed during the year. In a few cases changes in the pattern of use of pesticides on these commodities were recommended to prevent the occurrence of pesticide residues in the products.

An investigation into the quality standards set for formulated pesticides has been completed. The results indicate that the present proposed quality restrictions are so broad that all formulated pesticides would be able to comply with the requirements. Stricter quality restrictions should be introduced to keep poor products off the market, but this will require a great deal of additional research.

Several new research projects were undertaken. The effect of anti-evaporants on the sprayability of a preparation received attention because it is important to extend the time available for the aerial spraying of crops such as cotton.

This will mean that it will be possible for aircraft to spray for a longer period per day and that aerial spraying will become more economic. The factors that determine how rainproof sprays are were also investigated.

An intensive effort was made to improve the methods used for determining pesticides. Improved separation of complex mixtures of poisons by means of open-tube gas chromatography received attention, as did multi-residual methods for determining, *inter alia*, polar pesticides and synthetic pyrethroids. The importation of high precision thin layer chromatography to determine the concentration of pesticides more rapidly also received attention.

Several combined projects were completed during the year under review. In a study carried out in co-operation with the Oenological and Viticultural Research Institute it was found that the newer nematocides used on grapes do not leave any residues by harvesting time. Assistance was given with the analysis of dairy products from the Eastern Cape for residues of organochlorine pesticides. This project was carried out in co-operation with the University of Port Elizabeth and the City Council of Port Elizabeth. The stability of the weedkiller MSMA used for the control of jointed cactus was investigated. It was found that MSMA does not break down for at least 8 months. Parathion samples were analysed on behalf of the Department of Health, Welfare

and Pensions in cases where farm workers had been poisoned.

Insect pests of cotton

During the year under review the pesticides RH-0994, DPX 5444 and Sev/Pilot underwent final evaluation. All three appeared promising under laboratory conditions. Further development work is being left to the pesticide firms involved. The synthetic pyrethroid AC 222 705 did very well and has been included in field trials at Rust der Winter for further development. Two new candidate pesticides, a synthetic pyrethroid SSA 8183, and a carbonate DPX 3247 were received and are being evaluated.

Processed crop results for the 1979/1980 season confirmed the findings of the reconnaissance surveys that the synthetic pyrethroid pesticides registered at present effectively control the bollworm complex species at a weekly dose of 35 % of the fortnightly dose registered at present. A suppressive effect on aphids has also been observed in all the synthetic pyrethroids. The synthetic pyrethroid AC 222 705 has been found to suppress red spider mite.

Preliminary results indicate that red spider mite populations again showed an increase with the synthetic pyrethroids registered at present. It is also apparent that the population increase is faster with a fortnightly dose than with a weekly dose. All the synthetic pyrethroids provided effective control of the American bollworm under high population pressures. Sevimol 30 (carbaryl/molasses) in the spraying programmes stimulated red spider mite in the same way as carbaryl is known to do.

Follow-up exposures of larvae collected from the Komatipoort area where a resistance factor of three to endosulfan was found in 1978 revealed a factor of 0,7 in 1980. No tendency towards resistance to endosulfan could be found in larvae collected from the Eastern Transvaal Lowveld.

BIOLOGICAL AND INTEGRATED CONTROL

Stalk borers and American bollworm

Research on the possibility of biological control of the American bollworm on cotton led to an investigation into the current use of egg counts for the determination of economic threshold values for spraying. The purpose of the investigation was to keep spraying to a minimum by estimating the numbers of the pest population accurately. It was found that the percentage of bollworm eggs that give rise to the larvae vary so much that the use of egg counts in spraying programmes is completely unreliable. Economic threshold values based on larval counts were therefore determined and as soon as all the yields have been established it will be possible to determine crop losses at various levels of larval infestation.

In conjunction with the design of a sequential sampling technique which makes the task of reconnoitring the larvae far easier, this work should shortly make the control of the American bollworm cheaper and more reliable.

The development and research on bulk breeding techniques for egg parasites have virtually been completed and it should shortly be possible to use the bulk release of parasites in the field in the campaign against the American bollworm.

Four different synthetic pheromone component mixtures were tested for their attractiveness to male American bollworm moths. Of these (z)-11-hexadecenal + (z)-9-hexadecenal : 95:5 was significantly better than the other three. Investigations showed that the rate of release of these synthetic pheromones from nylon microtubules was more constant than with the commonly used impregnated rubber stoppers and that this tended to reduce the variations in trap catches that are so characteristic of widely fluctuating release rates. This work is to be continued to evaluate the potential of pheromone traps for monitoring field populations of the American bollworm.

Attempts to control stalk borers on grain crops by biological means are beginning to make progress. A very promising wasp parasite was imported from Pakistan this season. An effective method of breeding was developed and about 10 000 insects have already been released this season on the Springbok Flats and in the Highveld. The establishment of the parasite is being monitored and the intention is to release large numbers of parasites next season.

Karoo caterpillar

During the period under review outbreaks occurred in most parts of the Central Karoo, where good rains followed the dry conditions of the past few years. The initial evaluation of the roles of natural enemies and host plants in the seasonal abundance of the Karoo caterpillar is nearing completion. This study indicates that further attention should be given to the role that host plants play in outbreaks of this pest.

Plant mites

Field establishment of *Phytoseiulus persimilis*, an exotic mite predator of spider mites, has been noted in areas of the Western Cape where no releases have ever been made. Work on increasing the predatory mite's resistance to pesticides and monitoring any build-up of resistance in the spider mite population is in progress.

Vine mealybug

The continuing field experiment showed that both chemical and physical grapevine trunk treatments to exclude pugnacious ant, *Anoplolepis custodiens*, are effective for only one season. Integrated control of vine mealybug, *Planococcus*

ficus, remained inadequate in the second season even where ants were excluded. Although active parasitism was 40 % in the fourth instar at harvest, it was less than 4 % in the first two instars. A request has been made to Israel for a supply of the parasitoid, *Clausenia josefi*.

Field crops

During the year a number of aphid-eating tortoise beetles were imported with the object of augmenting the natural enemy complex of aphids in field crops. The species were *Adalia bipunctata*, *Coleomigilla maculata*, *Coccinella septempunctata*, and *Hippodamia convergens*; they are in culture at present and will be released in the Eastern Free State during the present wheat season with the co-operation of the Small Grain Centre at Bethlehem.

BIOLOGICAL CONTROL OF WEEDS

Hakea

Field populations of the hakea fruit weevil *Erytanna consputa* are still making good progress throughout the hakea-infested areas. At one of the experimental sites the weevil prevented nearly 58 % of the fruit from maturing during the last season. This represents a twofold increase in weevil damage from the previous year.

A large release of 1 200 larvae of the hakea seed moth *Carposina autologa* was made. The technique for implanting the larvae into the fruits was also improved. It is hoped that three viable hakea seed moth colonies are now established in the field.

Owing to a lack of insects, no further releases of the hakea leaf weevil *Cydmaea binotata* were made. The weevils are, however, thriving in the field and widespread establishment should not present a problem.

Work on the hakea bud weevil *Dicomada rufa* (= *Cydmaea* sp.) was suspended, because of the prospect of using more effective insects.

In January Dr S. Naser left to undertake a two-year study of hakea insects in Australia.

St. John's Wort *Hypericum perforatum*

An evaluation trial with the gall midge *Zeuxidiplosis giardi* was completed and has shown that it can suppress growth and retard development of St. John's wort seedlings. Its effect on the survival of the seedlings does not, however, appear to be as significant as was first thought.

Specificity tests of the St. John's wort aphid, *Aphis chloris*, have also been completed and permission for its release will be requested soon. The root-boring beetle, *Agrilus hyperici*, has again failed to establish itself.

Jointed cactus

A new mass releasing technique for the moth *Mimorista pulchellalis* has been developed at

Uitenhage. To date, 26 274 adults have been released, mainly in the Uitenhage area, but with smaller releases at Grahamstown and Ladysmith (Natal). The insect has become established at all of these localities but populations have remained small, showing little impact on the weed population at this stage. Attempts to identify factors hindering an increase in population are being studied at Uitenhage and Grahamstown.

All mass releases of *Tucumania tapiacola* have ceased. The insect is well established at six localities but is not abundant at any. It has recently been found that *T. tapiacola* has discrete instead of overlapping generations. The discovery of a second species (or subspecies), which may be better suited to South African conditions, has given a new dimension to this project.

Prickly pear

Biological control of young plants by *Cactoblastis cactorum* supported by *Dactylopius opuntiae* remains highly efficient. Large plants, however, should be controlled chemically. A new stem injection method using a highly systemic herbicide has been developed and will enable landowners to control this weed economically.

Life table studies on *Cactoblastis* have revealed that high winter mortality of pupae is caused by a high predation rate, parasitism by *Brachymeria* spp. and a fungus disease.

Newly established laboratory cultures of the beetle *Metamasium spinolae* are aimed at mass releases in the Uitenhage area. Biological control of prickly pear by this insect remains impressive in the Springfontein area of the Uitenhage district.

Lantana camara

Where possible, adult leaf mining beetles were collected at Margate and distributed further up along the Natal coast. After four years it appears that the beetles are starting to build up at La Mercy, north of Mount Edgecombe. The beetles are still being mass bred and released at Letaba and Tzaneen. Large numbers of *Leptonyrsa decora*, a sucking insect, were bred and released, especially in the North-Eastern Transvaal. This project has therefore now reached the stage where it is essential to release the insects over as wide an area as possible.

INSECTS IN STORED PRODUCTS

Trials with dichlorvos in mills, as a replacement for pyrethrum, have been completed and it appears that dichlorvos is effective and safe for workers if the workers do not enter the building for 12 hours after application. Residues on grain products were often high, however, and it will only be possible to use the preparation if such products can be stored for over seven days without further contamination before being made available for consumption.

Chlorpyrifos-methyl was registered for use on wheat and was tested together with three other preparations on a small scale this year for use on maize. The other three preparations were etrimphos, metacriphos and permethrin. Chlorpyrifos-methyl and permethrin did very well, etrimphos did well and metacriphos was the poorest of the four. No off-flavours were found and full-scale trials under practical storage conditions are planned for the coming storage season.

Pirimiphos-methyl was tested as a seed protectant on hybrid maize seed this year and produced very good results. The germination and emergence of seed were not affected and insect infestations were prevented. The use of the preparation will eliminate expensive fumigations and seed that is not sold could possibly still be utilised as consumer grain, unlike seed treated with the present registered seed protectants.

BEE RESEARCH

A small-scale experiment at Delmas on the role of honey-bees in the seedset of hybrid sunflowers showed that the presence of honey-bees significantly increased seed production. A similar trial on a larger scale is being repeated at Settlers.

Several farms on the Springbok Flats where a serious degree of hollow-seediness in sunflowers occurred were visited. Samples of sunflower heads were collected at various distances from the perimeter of a field where honey-bee colonies had been placed. There was no indication that a lack of pollinating insects was responsible for the hollow-seed conditions.

Pollen analysis of a variety of "new" honeys made it possible to update the table of bee-plants. With the aid of this technique the bitterness of two honey samples from Botswana and one from the South-Western Transvaal was traced to sisal nectar.

A start has been made with planting a variety of eucalypt species at Rooideplaas. These gums are to be tested for their suitability as beeplants and as a source of forage.

The inspection of flowering *Eucalyptus saligna* plantations in Politsi, White River and Piet Retief was carried out to find the cause for the decline in the nectar flow. From the preliminary results it would appear that the cause is the larvae of a very small species of vinegar fly which develop in the flower cups and feed on the nectar.

The role of the honey-bee in pollination was further investigated through a study of the effect of distance from the pollinator on fruit set. Preliminary results indicate that the set on the near sides of trees surrounding the pollinators is greater than that on the remote sides. The effect of prevailing winds will be investigated when more meteorological data are available.

A publicity campaign has been mounted to alert all beekeepers as well as the general public to the dangers of the Varroa mite. This mite, previously confined to south-eastern Asia, has been reported in Europe and South America, where it is

spreading rapidly. It is a very difficult parasite to control, especially where bees breed throughout the year, as in South Africa. The campaign is aimed at protecting the local beekeeping industry by keeping this mite out of the country.

Extension work continues to be an important function of the section and requests for information were received from local beekeepers and students as well as beekeepers in Mauritius, Zimbabwe, Botswana, Lesotho, Nigeria and France. The bulletin on Beekeeping in South Africa has been revised and will be reprinted in the near future.

POLLINATION OF LUCERNE

The number of active nests of the carpenter bee *Xylocopa caffra* in the two experimental sheds at Oudtshoorn has increased from 50 to 98 % and there are now sufficient bees to evaluate the performance of this species in pollinating lucerne. One problem noticed in early December 1980, however, was that *X. caffra* almost completely ignored lucerne in favour of a nearby group of *Prosopis* trees. Because the attractiveness of lucerne to *X. caffra* varies, other indigenous lucerne pollinators will be bred and tested.

FOREST AND TIMBER INSECTS

Defoliators

Pine tree emperor moth was responsible for the defoliation of 100 ha of *P. radiata* at the La Motte State Forest during August/September 1980. No reports of damage by the willow tree emperor moth were received.

Bark beetles

Plantations in Natal and in the Eastern and Northern Transvaal were visited to inspect trees and to advise growers on control measures against *Hylastes angustatus*. Some serious attacks of this bark beetle were noticed, especially in the Crammond and Bulwer districts of Natal. Studies on the European bark beetle *Orthotomicus erosus* included trapping methods and the discovery and subsequent study of a wasp parasite. Two localised infestations of this beetle are being monitored in the La Motte and Jonkershoek State Forests in the Western Cape.

Subsequent to the forest fires that devastated extensive areas of pine plantation in Natal, large numbers of *Xyleborus saxeseni* appeared. Investigation showed that these bark beetles were secondary pests of burnt trees.

The black pine aphid

During the winter of 1980 the black pine aphid was rife in the Eastern Transvaal Lowveld, Swaziland and the Natal Midlands. Damage in the form of scion dieback again occurred, especially in areas that had a dry spring and early summer.

During May and June 1980 a visit was paid to the USA with the object of investigating the

possibility of biological control of the black pine aphid. The visit was highly informative and a number of species of natural enemies were imported from overseas for release against the black pine aphid. In all more than 90 000 eggs of two imported tortoise beetles *Harmonia axyridis* and *Olla abdominalis* were released at various localities in the Eastern Transvaal. Present indications are that *H. axyridis* especially will do well in South African conditions.

A study of the biology of the black pine aphid revealed that the unwinged adult aphid produces an average of 67 young in her life of 21 days. The winged adult produces 41 young in 19 days. Although these figures are not particularly impressive, the special biological adaptation of the black pine aphid nevertheless enables it to double its population 54 times in the span of one generation. The biological control programme is aimed at controlling this fertility.

The survey of black pine aphid numbers with the aid of Moericke traps clearly shows year-to-year fluctuations in the severity of infestation. In the Eastern Transvaal infestations were especially severe in 1978 and 1980, whereas 1979 was a fairly quiet year. It is not yet possible to explain these variations in numbers. However, there are indications that the growth rate of the host trees affects the severity of aphid infestations.

The pine woolly aphid and pine needle aphid

Two new aphid pests appeared in pine plantations during 1980. The first was the pine woolly aphid, which was observed during the winter of 1980 in the Elandshoogte plantation at Machadodorp, and subsequently spread to plantations near Sabie. At Elandshoogte all pine species were attacked but the major damage was to *Pinus patula* and *P. kesiya* compartments. Although a few trees were killed, the damage was light in general and was confined to dieback of the growing points of the lowest branches. The pine needle aphid was observed for the first time in October 1980 in pine plantations at Louis Trichardt and Tzaneen in the Northern Transvaal. The pine needle aphid attacks the needles directly and not the back of the trees, as does the black pine aphid and the pine woolly aphid, and probably entered South Africa from the North. It was reported in Zambia in 1978. The needle aphid has spread fast, however, and is already present in all forestry regions, even in the Western Cape. Although large populations of the needle aphid occurred during the past autumn months, damage was light in general and was confined to the older needles.

Population surveys of the pine woolly aphid and the pine needle aphid are being undertaken at present.

Timber insects

A total of 4 500 larvae of the European house borer *Hylotrupes bajulus* were established in culture. Tests carried out during the year included the second annual evaluation of the presently

registered and approved timber preservatives (in collaboration with the S.A. Forest Research Institute) and a further evaluation of lindane in a pyrotechnic formulation. So far, all preservatives tested maintained their efficacy against wood-boring insects.

ANIMAL PESTS

National collection of nematodes

The collection of nematodes was expanded to 16 770 microscopic slides, representing about 67 000 specimens. A rye grass survey in regions outside the Western Cape revealed no infestation with the nematode *Anguina agrostis*. A survey of apricot orchards in the Little Karoo and Ceres/Clanwilliam area showed that very few nematodes are present in the orchards. Of the nematodes found, ring nematodes were the commonest.

Taxonomic studies include the description of new *Scutellonema* and *Rotylenchulus* species and the conclusion of the study of the stunt nematodes (Tylenchorhynchidae). Four new species were described, viz *Amplimerlinius omentales*, *Paratrophurus longus*, *P. anomalus* and *Histotylenchus lechrus*.

A doctoral thesis was submitted on the basis of this work. Studies of the Longidoridae and *Hemicyclophora* are continuing.

During the year under review 1 844 routine soil, seed and root samples were processed. The majority of these samples, namely 1 130, were samples of nursery and imported material from the Division of Plant and Seed Control and the rest came from farmers, and Departmental and other bodies.

Virus transmission by nematodes

Populations of four *Xiphinema* species are being maintained under glasshouse conditions on either grapevines, figs or strawberries. Fig has proved to be the most suitable host plant for *X. index*. ELISA tests indicated that two of five virus-free vines planted in pots containing soil with viruliferous *X. index* became infected with GFV. Virus was also detected in the roots of healthy vines in sterilised soil within four months of inoculation with infective *X. index*.

Control of nematode virus vectors

Four years after treatments to eradicate virus vectors, populations of *Xiphinema index* on treated areas were considerably higher than those on untreated controls, not only in the shallow soil layers but also down to a depth of 0.8 m, where the largest numbers occurred. Using ELISA on macerated nematodes, 70 % of samples tested were shown to contain virus particles. The overwhelming majority of grapevines were also infected. The possibility of reclaiming land infested with GFV and a nematode vector under local conditions appears to be extremely remote.

Presence of nematodes in irrigation water

It appears from a study being conducted in the Stellenbosch area that many nematodes, including a variety of plant parasites, are being disseminated locally in river water. Population densities vary, but seem to be at their highest after or during rain. Average numbers of nematodes per litre of water were 0,3 from all sources during the past year. Ninety per cent of the nematodes recovered were freeliving.

As far as is known, nematodes were recovered for the first time from municipal tap water in South Africa. During January 1981, 180 nematodes, 31 of them plant-parasitic, were counted in a 100 l water sample.

Rootknot nematodes

Rootknot nematodes of the genus *Meloidogyne* are the most important nematode parasites of field crops and horticultural crops in South Africa. It is important to establish which species attacks each crop in order to make meaningful recommendations on rotational cropping systems and breed nematode-resistant plants. The identification of the nematodes depends on the morphology of the females and the second larval stages and on the differential host response. In order to obtain material for these studies the establishment of pure cultures of the nematodes on susceptible host plants was started in the glasshouse.

Nematodes in maize

During 1979/80 fumigation with ethylene bromide and the application of FMC 35001 resulted in a reduction in nematode numbers in maize. The reduction in nematode numbers was not reflected in the yields, however, since no difference was found in the yields obtained from the various treatments and the control. Because several factors, such as drought, could be responsible, the same two preparations were tested again, with carbofuran. All three preparations had an effect on the nematode population. The application of FMC 35001 produced the best results, however.

National collection of Arachnida

Accessions of mites amounted to 749 and those of spiders to 592.

A total of 934 identifications of mites and 122 of spiders were carried out during the year under review. These included identifications for Zimbabwe, Réunion, the Netherlands, Surinam, Israel and India.

The yellow tea mite *Polyphagotarsonemus latus* has become a pest of great economic importance in tea at Tzaneen. *Calacarus carinatus* (purple tea mite), a very important pest of tea in South-East Asia, was identified for the first time in South Africa on tea at Barberton and Nelspruit.

A survey on cotton at Rust der Winter revealed that the spider *Pardosa crassipalpis*, which

is a predator of the red spider mite *Tetranychus cinnabarinus*, was the most dominant spider species throughout the cotton season.

Cotton mites

A candidate acaricide, Me 20138 (organophosphatic) was evaluated during the year. Its efficacy was determined against adult red spider mite females and eggs under laboratory conditions, and compared well with the standard acaricide triazophos. An mortality of 8,5 % at the recommended field dose was established.

Investigations to determine the economic threshold values of red spider mite populations on cotton were carried out during the past two seasons by means of field trials at Groblersdal.

There are significant connections between the mite populations present and the accompanying percentage of leaf damage and crop loss. During the 1979/80 season it was established that two sprayings at field dose during the early stage of population build-up (12 to 16 weeks after plant emergence) are the most economical treatment. This means that control methods have to be started as soon as the first signs of mite infestation are observed. In the 1980/81 season it was found that a population peak of up to 10 adult females per leaf at about 17 weeks after planting caused no statistically significant crop loss. Control late in the growing season was advantageous in the case of late plantings where protection is given to the plant during compensation for lack of boll formation during an early unfavourable fruit formation period.

During the past two seasons the significant differences in crop masses between plots subjected to different mite populations first showed up prominently during the latter part of the harvest. The reason is that the mites normally only appear in the cotton field from about 12 weeks and first start causing economic damage from about 16 weeks. The early crop therefore normally escapes mite damage. During the 1979/80 season mites made their first appearance from about 14 weeks and in the untreated plots the mites resulted in a crop loss of 13,4 %. During the 1980/81 season the mites made their first appearance at about 12 weeks and in the untreated plots an average crop yield of 16,8 % lower than in the control plots was recorded.

Until more information becomes available, producers are advised to base the control measures they apply against red spider mite on the economic threshold values currently recommended by the Department.

Mites were collected from four different geographical areas in the Loskop irrigation area during 1980 and subjected to triazophos in the laboratory to investigate the occurrence of resistance. No difference in mortality reaction was found between the four different areas, which indicates that there is no resistance to triazophos.

From a commercial point of view no problems should be experienced with practical control measures, since the registered dose of triazophos provides effective control. A strong appeal is made to all cotton producers to carry out the recommended control programme for the pest complex on cotton meticulously and so to ensure that unnecessary spraying with triazophos is avoided.

Rodents

Two rodenticides, scilliroside and brodifacoum, were tested in the laboratory against *Tatera brantsii*, the Highveld gerbille. Scilliroside was tested in no-choice feeding trials at concentrations of 0,035 % and 0,05 %. All the experimental animals survived an exposure period of two days at these concentrations.

In addition, a palatability trial with 0,05 % scilliroside established that this preparation causes a visible taste effect which makes it unacceptable to gerbilles. The poor results obtained at a concentration of as low as 0,05 %, with accompanying unpalatability, mean that scilliroside has no potential use for the control of *T. brantsii*.

Laboratory trials were carried out with brodifacoum at concentrations of 0,005 % and 0,002 %. Although excellent results were obtained with both concentrations, a slight taste defect was detected at the higher concentrations. The concentration of 0,002 % should therefore provide the best results under field conditions.

PLANT PATHOLOGY

Mycology

Fungus identification: Among the large number of fungi identified for workers in other Institutes were many interesting species and important pathogens of plants such as *Colletotrichum gloeosporioides* on *Phormium tenax*, *Puccinia asparagi* on *Asparagus* sp. from Hartswater, *Fusarium oxysporum* on castor oil plants in the North-Western Transvaal, *Coprinus micaceus* associated with butt-rot of ornamental trees, *Trametes hispida* on *Citrus sinensis*, and *Phytophthora* spp. from root rot of lucerne.

Taxonomy

The study of the South African species of *Colletotrichum* was finalised. Nine species are recognised and were described in pure culture.

A study of fungi associated with root rot of lucerne was started and a number of isolates of *Phytophthora* spp. from diseased roots are being studied to establish their identity.

A study of *Phialophora* spp. on roots of grasses revealed the occurrence of three different species of this genus. One species was found to be very common on a wide range of cultivated and wild grasses. Another species is associated with roots of maize. Studies to determine the identity,

host ranges and distribution of these fungi and their effects on hosts are continuing.

Cultural and anatomical studies of different isolates of *Sclerotinia sclerotiorum* from fieldbeans, soybeans and sunflower showed that all the isolates have the cultural and anatomical characters of *S. sclerotiorum*. A study of some aspects of the biology of this fungus in a field of sunflowers on naturally infested soil supplied information for the control of this serious pathogen.

Toxigenic fungi in stockfeed

A total of 104 samples of stock feeds were examined for the presence of toxigenic fungi. *Fusarium moniliforme*, *Aspergillus clavatus* and *Aspergillus flavus* were the toxigenic species encountered most frequently. One sample of maize was severely infected with *Diplodia maydis*. Although this species is regarded as toxigenic on maize, feeding experiments conducted by the Veterinary Research Institute with this material proved negative.

A survey of the occurrence of *Pithomyces chartarum* on plants in a Karoo pasture was continued. Results agreed with those obtained earlier but with the occurrence of frequent and heavy rains later in the season this fungus virtually disappeared from the pastures.

A total of 96 litres and 112 litres of medium for bulk culturing of *Aspergillus clavatus* and *Pithomyces chartarum*, respectively, for use in toxicological experiments, were supplied to the Toxicology Section of the Veterinary Research Institute. A further 315 isolates of *Pithomyces chartarum* were tested for their ability to produce sporidesmin in culture. The great majority of these isolates were not toxigenic under these conditions.

Curatorial work

A total of 153 new specimens were deposited in the National Fungus Herbarium to bring the total number of specimens to 45 858. Eight specimens were sent on loan to workers in New Zealand and Australia.

Phytophthora cinnamomi - root rot

Consequent to the high incidence of *P. cinnamomi* recorded in Western Cape rivers, the pathogenicity of isolates from major Western Cape rivers has been demonstrated on *Leucospermum cordifolium*. Although populations of *P. cinnamomi* in river water pumped into natural farm dams for storage declined rapidly within a few days, zoospores of the fungus were able to survive in water for longer than one month under ideal conditions. The survival of zoospores and other spore forms of the fungus under ideal and natural conditions is being examined to determine the minimum storage time required to assure the complete absence of fungus from irrigation water.

Crown gall

Sampling conducted this year showed that the crown gall pathogen *Agrobacterium tumefaciens* occurred in nurseries throughout South Africa. Research aimed at achieving biological control of biotype 3 is continuing. The crown gall pathogen has been isolated from rivers serving as water sources for nurseries with crown gall disease problems and from plants growing on the banks of these rivers.

Disease-free bean seed

During the past year the disease-free dry bean scheme received further attention. Seed of a number of dry bean cultivars has been available to the farmer for some time and is undergoing further multiplication by the private sector. Seed of recognised and new cultivars in foundation quantities is routinely purified and multiplied with the aid of techniques developed at this unit.

Sufficient quantities of foundation seed of eight green bean cultivars have been multiplied and should shortly be generally available.

A fact that will have to be taken into account in the future purification of bean seed from bacterial pathogens is that these pathogens have now also been isolated from *Macroptilium atropurpureum*. Similar problems are experienced with the purification of soya-bean seed, since bacterial pathogens of this crop have also been isolated from *Neontonia wightii* for example.

Diseases of fruit trees

A data bank for storing information on temperate fruit tree diseases occurring in South Africa and overseas has been established. Information is continually being fed into the data bank and is available to all agricultural scientists in South Africa. Techniques for better field diagnosis and more rapid laboratory identification of the bacterial pathogen, *Xanthomonas compestris* pv *pruni*, which causes bacterial spot of stone fruit, have been developed. These techniques were utilised to select *Xanthomonas*-free material for plant improvement schemes and to locate nurseries where the disease problem exists. *Rossellinia* root rot of apples and pears was discovered in one of the two oldest nurseries in the Langkloof.

Plant viruses

At present special attention is being given to the development of immunological tracing procedures for all races of viruses that attack pomes, drupes and grapevines. Problems encountered in the past with the linking of the enzyme and anti-serum in the enzyme-linked immunosorbent assay were overcome by the use of conjugated rabbit antibodies, produced in a sheep. It is therefore now possible to trace all races of grapevine fanleaf virus with the aid of a single test.

As a result of the unstable nature of apple chlorotic leafspot virus a number of antigenic plant

components remain behind when soft purification procedures are used and this makes the final anti-serum unsuitable for use in the enzyme-linked immunosorbent assay. The use of the antiserum in immunosorbent electron microscopy has shown, however, that apple chlorotic leafspot virus could be traced successfully.

Preliminary results with the development of a tissue culture medium for grapevines indicate that 2 parts per million of benzyl adenine in the presence of one tenth of a part per million of alpha naphthalene acetic acid is optimal for shoot development. It was possible to establish a broad range of scions and rootstocks from meristems of less than 1 mm in length. This is a notable breakthrough in an attempt to free economically important table and wine grape cultivars from heat-resistant viruses.

Diseases of pastures

In the Little Karoo, lucerne decline is attributed to the combination of adverse environmental factors and root diseases, especially *Fusarium* root rot. Plants with "witches broom" symptoms were also observed in this area. In the Malmesbury and George districts, leaf and stem spot diseases caused by *Phoma* spp., *Leptosphaerulina trifolii*, *Stemphylium botryosum*, *Pseudopeziza medicaginis* and *P. janesii* were found. An investigation of the major diseases of annual *Medicago* sp. has been started.

A fungal disease of subterranean clover previously unknown in South Africa was identified as *Fusarium* root rot and is caused by *F. oxysporum*, *F. solani* and *F. moniliforme* var. *Subglutinans*.

The disease occurred mainly between Swellendam and Humansdorp in the Southern and Eastern Cape. Clover plantings inspected were found to be between 95 and 100 % infected. A high degree of dwarfing and dieback occurred in infected plants.

Biological nitrogen fixing

Research aimed chiefly at developing better nitrogen fixing *Rhizobium* races for legume inoculants and finding races for new promising legume crops was continued. Considerable success was achieved, which ensured that the best available *Rhizobium* races could be made available to inoculant manufacturers. Research on free-living nitrogen fixing bacteria that occur together with grasses continued. A fair amount of information on the relative importance of these bacteria has already been obtained and research projects in this field will probably be wound up shortly.

To ensure that only the most effective *Rhizobium* races reach the manufacturers of inoculants, 29 selected races of *R. meliloti*, 27 of *R. trifolii*, 7 of *R. leguminosarum*, 14 of *R. lupini* and 18 from the cow-pea group were tested at 6 different localities in the RSA in field trials. In addition 297 *Rhizobium* inoculants (for 77 crops)

not manufactured commercially were sent to interested farmers for research purposes.

This year inoculant manufacturers submitted 390 batches of inoculant for quality tests. Of this number 342 batches were approved. A total of about 235 000 units of inoculant were sold to farmers, which is an estimated increase of about 10% over the figure for the previous year. The quality of the inoculants was good in general and in fact the South African farmer has some of the best inoculants in the world at his disposal.

Inoculants for use against crown gall were again made available to farmers this year for use on drupes. Research to obtain new and more effective inoculants that can be used for a wider host range is being undertaken at present.

LEGUME RESEARCH

Pasture legumes

Plant introduction

The importation from overseas of seed of pasture and forage legumes with potential for South African conditions continued. During the year under review small seed samples of 60 pasture legumes were obtained.

The lucerne cultivars Springfield and Cuf 101, and the annual *Medicago* spp. were imported in expectation of a possible infestation with the spotted lucerne aphid *Thesioaphis trifolii* and the blue-green aphid *Acyrthosiphon kondoi*, which caused an enormous amount of damage to these legumes elsewhere in the world. The material involved is known to be tolerant or resistant. The presence of the blue-green aphid in South Africa was recently confirmed.

Nursery studies

During the year under review a large number of temperate and three subtropical to tropical species and cultivars were planted in nurseries. Some were new accessions and others were accessions from previous years that were planted again for further observation and seed production. Thirty temperate and subtropical species were successfully established.

Seed multiplication and distribution

Seed multiplication of pasture legumes following requests from both inside the Department and from other sources continued. In most cases only small seed samples were distributed, but in the case of *Ornithopus compressus* cv. Pitman, *Vicia dasycarpa* cv. Namoi and *Trifolium vesiculosum* cv. Amclo considerable quantities of seed were distributed. During the current winter season large areas of *Trifolium vesiculosum* cv. Amclo, *O. compressus* cv. Pitman and *V. dasycarpa* cv. Namoi were planted for seed multiplication.

Yield trials with annual temperate pasture legumes

A trial with annual *Medicago* species was carried out at Rietondale under irrigation. The 20 entries included 8 cultivars.

Dry mass yields of the various species and cultivars did not differ very much from *M. tornata* SA 1970 (15 t/ha), which was the best, and *M. truncatula* cv. Jemalong, which was the second best (12 t/ha). *M. murex* was the poorest with 4 tDM/ha, owing chiefly to nodulation problems.

A further trial with 8 entries, namely four serradellas, *Vicia dasycarpa*, *Lathyrus sativus*, *Trifolium subterraneum* and *T. vesiculosum* was also carried out at Rietondale under irrigation. Good dry mass yields (7 to 15 t/ha) were obtained from the serradellas and from *Vicia dasycarpa* and *Lathyrus sativus*. *Trifolium subterraneum* was the poorest. With regard to the effect of defoliation, ordinary serradella, Pitman serradella, *O. perpusillus* and *T. subterraneum* were favoured, serradella 16379, *V. dasycarpa*, *T. vesiculosum* were at a disadvantage and the production of *L. sativus* was not affected.

Yield trials with annual temperate legumes

A yield trial with entries was carried out. The pH of the soil was low, which particularly handicapped the *Vicia faba* lines.

The best seed crops were obtained from *Lupinus albus* cvs Kiev, Ultra and Neuland, which produced 2,9, 2,8 and 2,6 t of seed/ha respectively. *Lathyrus sativus* produced the lowest yield - 390 t/ha. Other entries that yielded poorly were *Cicer arietinum* and *Lupinus luteus*.

Field peas *Pisum arvense* yielded satisfactorily, Derrimut (2,2 t/ha) being the best and WP1, with 1,4 t/ha, the worst.

Yield trials with annual subtropical legumes

Six cow-pea cultivars *Vigna unguiculata* were compared in a field trial. Saunders Regop produced the highest total dry mass (5,9 t/ha), but the seed crop of this cultivar was the second poorest, namely 594 kg/ha. The DM and seed yields of the other cultivars varied from 4,6 to 5,0 and from 0,5 to 1,8 t/ha respectively.

PHYTOSANITARY SERVICES

Plant material for quarantine purpose

The following table gives particulars of the times and numbers of units imported by the Quarantine Station at Stellenbosch during the past year:

Release of material from quarantine

The following plant units were released from quarantine:

Crop	Number of plant units
Almonds	18
Apricots	11
Apples	6
Strawberries	1
Bamboo	1
Hops	4
Cherries	10
Olives	1
Peaches	48
Plums	9
Pears	1
Blackberries	5
Table grapes	4
Wine grapes	18
Figs	5
Total	142

Crop	Number of plant units
Apples	3
Apricots	7
Strawberries	4
Blueberries	7
Hops	11
Pears	3
Peaches	42
Plums	5
Table grapes	13
Wine grapes	32
Total	127

Available foundation material

The development of S.A. super plants is being given high priority and at present there are 185 plant units in stock at the Plant Quarantine Station at Stellenbosch, which includes pome and drupe, wine grape and table grape cultivars. The kinds of plants and numbers of units are shown in the following table:

Crop	Number of plant units
Apples: Cultivar/rootstocks	29
Almonds	8
Strawberries	4
Quince rootstocks	2
Cherries	19
Plums/prunes	20
Peaches	35
Pears: cultivars/rootstocks	10
Apricots	10
Table grapes: cultivars/rootstocks	12
Wine grapes	46

There are already indications that S.A. super plants perform better than the available propagating material. The value of this material should be seen to lie in higher production and better quality per ha without the producer having to incur additional expenditure.

Development of quarantine facilities at Buffelspoort

Some of the most essential facilities required for quarantine have now been created and the station is now in full operation.

Quarantine plantings

The following table provides a synoptic review of plant material subjected to quarantine at Buffelspoort during the past year:

Plant material	Number of cultivars or lines
Seed samples	
Vegetables	4
Oilseeds	7
Summer and winter cereals	514
Forage crops	14
Other crops	7
Vegetative propagating material	
Pines	7
Cassavas	88
Mulberries	5
Cycads	1
Grasses	1
Kiwi fruit	2
Garlic	6
Succulents	73
Total	729

The importation of desirable seed lines and cultivars, especially for breeding purposes, was continued. The properties of this seed include increased production or resistance to diseases; the latter property is important in meeting requirements in respect of increased production.

The vegetative material referred to consisted mainly of pine, cassava and mulberry imports, which were released during the past year. The pine scions come from the USA and Zimbabwe and were released to the forest industry; they will contribute to the improvement of the timber and pine seed industries. The cassava and mulberry imports are intended for new industries which are to be established in the national states.

Cassava from various parts of the world is being evaluated in separate research projects to investigate the commercial cultivation of cassava as an alternative source of energy.

In addition to the importation of various mulberry cultivars, a consignment of silkworms was also imported from Taiwan during the past year and quarantined. At the same time various imported mulberry cultivars were evaluated as sources of food. When this task has been completed, the Economic Development Corporation will probably soon be able to establish a labour-intensive silk industry in the national states.

LOCUST CONTROL

Brown locusts

The build-up area of the brown locust *Locustana pardalina* suffered a severe drought during the whole of 1980. Early in 1981 the drought was broken in most parts of the Central, Southern and Eastern Karoo and populations occurred in a number of districts such as Aberdeen,

Beaufort West, De Aar, Fauresmith, Graaff Reinett, Hofmeyer, Hopetown, Murraysburg, Philipstown and Richmond. A few hopper and flyer swarms were destroyed in the Murraysburg district and isolated flyer swarms were destroyed in the Districts of Beaufort West and Philipstown.

Build-up outbreaks of the brown locust are expected over a wide area early in the summer of 1981.

Tropical migratory locust

The biggest outbreak of the tropical locust *Locusta migratoria migratorioides* known so far occurred in the autumn and early winter of 1980. The outbreak was confined to the North-Western Free State, the Western Transvaal and the neighbouring districts in the Cape. The districts involved were Bloemfontein, Boshof, Bothaville, Brandfort, Bultfontein, Delareyville, Hennenman, Hertzogville, Hopetown, Klerksdorp, Kroonstad, Leeudoringstad, Lichtenburg, Mafikeng, Odendaalsrus, Potchefstroom, Schweizer-Reneke, Wesselsbron and Wolmaransstad.

Control was severely hampered by the fact that medium to dense concentrations occurred, but concentrated swarms very seldom formed. The maize was already ripe and the damage was confined chiefly to young wheat.

The highlight of the campaign was reached towards the end of April or the beginning of May 1980 when 71 control teams were put into the field. The campaign tailed off gradually and ended in July 1980. At the end of November 1980 isolated outbreaks occurred again in a number of districts such as Bothaville, Lichtenburg, Odendaalsrus, Wesselsbron and Wolmaransstad. These outbreaks were minor and as few as three control teams, generally on stand-by, were sufficient to control the outbreaks.

A few concentrations also occurred in the Districts of Prieska and Gordonia, but they were very minor.

During February 1981 outbreaks also occurred on a few holdings below the P.K. le Roux Dam. Current expenditure on the campaign amounted to R285 278 for insecticides, R142 167 for transport and R70 952 for wages.

TECHNICAL ADVICE

The Senior Technical Adviser (Insecticides and Fungicides) to the Registrar, appointed under Act 36 of 1947, attended the thirteenth sitting of the Codex Alimentarius committee of the FAO/WHO on pesticide residues in The Hague, in view of the important effect of pesticide residues on our edible exports. Active participation in the activities of this Committee was maintained throughout the year.

About 300 applications for registration and amendments to existing registrations of insecticides, fungicides and rodenticides were reviewed and the preparations were recommended for registration in terms of Act 36 of 1947.

The annual Departmental publication *A Guide to the Use of Pesticides and Fungicides in South Africa* (228 pages) was enlarged.

AGRICULTURAL ENGINEERING RESEARCH ON ENERGY FOR AGRICULTURE

Special attention is being given to research to find an alternative fuel for diesel tractors. The aim of this research is to make South African agriculture independent of imported diesel fuel. Work started in July 1979, when the testing of agricultural tractors powered by sunflower oil only was started. The initial results were so promising that it was decided to continue this research project on a large scale. The decision to use sunflower oil as an alternative fuel for diesel tractors was based on the fact that South African farmers have been producing sunflowers for many years and therefore have all the necessary knowledge. The farmers also have all the necessary agricultural machinery to cultivate the soil, prepare it and plant and harvest sunflowers. No additional machinery is therefore required for the cultivation of sunflowers and no special training needed. Sunflowers also have the advantage that they can be produced within the brief period of only one growing season in times of crisis, whereas synthetic fuels require vast investment and the processing plants take a long time to build. A particular advantage of sunflower oil is the favourable energy ratio between production and yield. A conservatively estimated yield of one and a half tons of seed per ha with an oil content of about 40% can yield 600 litres of sunflower oil. Surveys carried out on farms by the Division of Agricultural Engineering have shown that about 60 litres of fuel are required to produce 1 ha of sunflowers. It therefore takes 60 litres of fuel to produce 600 litres of sunflower oil as an alternative fuel, which is a favourable ratio of 10 to 1. Trials with agricultural tractors powered by pure sunflower oil or by mixtures of sunflower oil and diesel, petrol, kerosene and paraffin have shown that sunflower oil mixes readily with all these conventional fuels and there is little difference in the maximum power of the engines. No operator would notice the difference if the tractor were to be powered by any of these mixtures. Long-term endurance tests with engines powered by sunflower oil and mixtures of sunflower oil carried out both in the laboratory and under field conditions have shown that sunflower oil has great potential as an alternative fuel but that there are certain problems that will have to be solved before sunflower oil can be recommended as such. The Division has emerged as a world leader in this research field in that both the problems that arise and possible solutions have already been identified and scientific papers published on them. A further achievement of the Division of Agricultural Engineering was that for the first time an indirect diesel engine was

driven for over 2 000 hours on pure sunflower oil without any problems in the engine being detected.

The research activities are aimed at providing the technology so that South African farmers can grow their own fuel on their own farms and prepare it for their diesel tractors. In order to be able to inform farmers on the correct use of the oil press, the Division had special farm size oil presses manufactured and imported so that they could be tested. The results obtained with these presses enable the Division to advise farmers on how to set and operate presses to obtain the best results. The oil that comes out of the presses naturally has to be filtered or cleaned for use in diesel engines and here the Division is also engaged in investigating a few different methods, including conventional filters, sedimentation tanks and centrifuges. Further refinement of sunflower oil to esters of sunflower oil is also receiving attention, especially for use in direct injection diesel engines. Engineers of the Division manufactured equipment by means of which any farmer can prepare sunflower esters for his own use with very little trouble.

The storage of sunflower oil and sunflower oil esters is also receiving attention and special containers have already been made in which sunflower oil can be stored outdoors for periods of over a year without the fuel properties of the oil being impaired.

When the technology for using sunflower oil as fuel for diesel tractors has been perfected, attention will be given to the use of other vegetable oils as an alternative to diesel.

Until all the problems have been ironed out, farmers are seriously advised not to use sunflower oil or any other vegetable oil in diesel engines while diesel is still available.

Attention will be given in time to the use of solar energy, wind energy and hydraulic energy on South African farms.

TRACTOR POWER TESTS

Since the official testing of tractor power started about four years ago, 16 test reports have appeared, 8 of which were completed during the year under review. Although this year was a record one, it is clear that much remains to be done when one considers how many models of tractors there are on the South African market. Indeed, 6 of the 8 models covered by the latest test reports published are models of the same make, and the same numbers of other models of the same make are on sale in South Africa. Furthermore, there are about 14 different makes of agricultural tractors on the South African market, with a total of at least 130 models - and new models are added annually. Nevertheless the revival of interest is greatly welcomed and it is generally accepted that it will increase.

There are several reasons for the low tractor test report figures:

- For unavoidable reasons tractor tests are carried out only during the last half of the year.



This neck-clamp was developed by engineers of the Division of Agricultural Engineering in collaboration with animal scientists and farmers, and has become very popular. Plans of the design are obtainable from the Division

- Participation (or entry) is voluntary and many firms reason that the tractors (all of which are imported) are tested in their countries of origin - and the reports are available. However, conditions in South Africa differ a great deal from those under which the tractors were originally tested.
- The test findings are often unflattering and therefore do not promote sales, especially when available specifications give the engine power and the available power take-off power, which is naturally always far lower, is determined locally.
- Most overseas tests are carried out with special diesel fuel, whereas the local tests are carried out with ordinary diesel - which sometimes means significant differences in power.

Testing of Atlantis engines

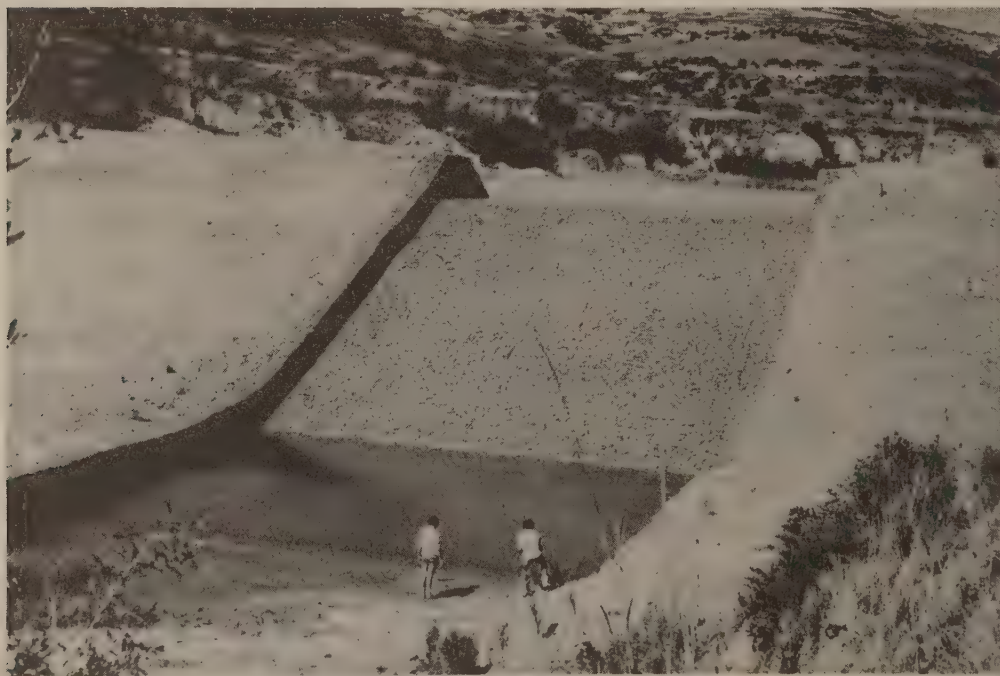
With the inclusion of the locally manufactured Atlantis diesel engine, the power testing facilities of the Division are expected to come into their own. Because it will shortly be legally compulsory for all tractors marketed locally to be equipped with Atlantis engines, the obvious way would be to have the tractors tested at the Division, in order to obtain a recognised test report, and to compare their power with that of

tractors equipped with imported engines. Several firms have already approached the Division about this matter.

TRACTOR SAFETY FRAME TESTS

The facilities for testing tractor safety frames at the Division of Agricultural Engineering have been in existence for about four years. Several pilot tests and a few trial runs have already been carried out but the first actual official test was completed only during the past year. The test report for the first approved safety frame of South African manufacture has recently been published.

The course of this test dramatically underlined the necessity for similar tests. The frame had to be improved four times before, upon the fifth testing, it complied with the requirements laid down. It should also be mentioned that the weaknesses and faults can generally not be observed with the naked eye. In practice this means that a safety frame that has not been tested can create a false sense of security, with potentially fatal consequences in the case of an accident.



Since the Soil Conservation Act came into force in 1946, about 400 key soil conservation works have been constructed by the Department under the guidance of its engineers. These works were constructed in severely eroded or vulnerable valleys. This is an exceptional type of structure which is erected where there is no solid rock foundation on the site to support the usually arched concrete spillway



Part of the permanent exhibition at the Division of Agricultural Engineering's headquarters in Silverton. It was specially erected to demonstrate milking-machine technology. All the important aspects which contribute to the successful use of milking machines are displayed visually

COMPARISON BETWEEN 4-WHEEL AND 2-WHEEL DRIVE TRACTORS

The claims of certain firms that 4-wheel drive tractors have up to a 40 % advantage in respect of work rate and fuel consumption over two-wheel drive tractors compelled the Division to investigate the matter scientifically, under practical working conditions at various sites. Tractors of the same engine size were compared. Briefly, the findings were:

- 2-wheel drive tractors are more responsive than 4-wheel drive tractors to skilful adjustment of the load, but if the implement is optimally adjusted to the tractor, the above claims are entirely unfounded. For general ploughing conditions 4-wheel drive tractors produced an average of less than 10 % higher performance than 2-wheel drive tractors. In haymaking and transport work the 4-wheel drive tractor normally offers no advantage and 4-wheel drive may even be a drawback and be uneconomic.
- Justification for the purchase of 4-wheel drive tractors was found, for reasons such as the following:

The convenience of being able to work even if conditions are unfavourable for cultivation, such as when there are wet patches in a field when the farmer wants to cultivate to remove weeds. Four-wheel drive is also required in very sandy or muddy conditions, where slopes are unusually steep (as in

the Western Cape), and for the sake of better steering control.

A 4-wheel drive tractor should also be used if the amount of available power simply cannot be transmitted by a 2-wheel drive tractor. Here one is thinking of tractors with a power shaft power of 150 kW and over.

PERFORMANCE OF THREE-POINT HITCHES

Almost all modern tractors are equipped with a hydraulic three point system. The functions of the system are to link the implements to the tractor and, in the case of soil cultivators, which usually make the highest power demands of tractors, to control the depth at which the implements work. The system can "feel" the varying traction power requirements of the implement and automatically adjusts the working depth in such a way that the tractor is pulling a constant load. However, it is found in practice that not all the systems function equally efficiently under South African conditions. The plough works at either too great or too shallow a depth and the operator often has to adjust the system by hand to prevent the tractor's engine from stalling or wheel slip becoming excessive.

The Division is engaged in investigating the performance of elevators under varying local conditions. The first phase is to measure the forces exercised on the three-point system by the plough

and a special apparatus for measuring stresses in the three-point hitches is being built for the purpose. Measurements have been carried out under a variety of soil conditions and will be supplemented with laboratory tests to correlate the field measurements with the properties of the hydraulic system.

The results processed so far show that the hydraulic system becomes unstable at excessively high sensitivity adjustments. It is also apparent from experience gained from the tests that servicing and maintenance of the elevator have a major effect on the performance of the system.

Mechanisation planning

Mechanisation and labour costs are generally the biggest single cost component in the production of crops. Owing to the high purchase prices and rapidly developing technology, making decisions on the purchase, leasing, sale and application of implements is a nightmare to many farmers. During the past decade engineers from the Division have developed a technique that can be successfully used to make these decisions easier and farmers, extension officers and technical staff of related suppliers are introduced to this technique at two-day courses.

The popularity of these courses is increasing and the latest developments are that mechanisation planning should be seen as an integral part of the total farm management and courses are regularly presented as part of the courses on farming or financial management arranged by co-operatives, universities and other bodies.

PROFESSIONAL AND TECHNICAL SERVICES

The Division provides a wide range of professional services. The following are the most important:

Grain silos. Grain silos for the bulk handling and storage of grain are administered mainly by agricultural co-operatives and mills, in consultation with the Directorate of Agricultural Economics and Marketing of the Department of Agriculture and Fisheries, with the Director of the Division acting as technical adviser to the grain silo committee and supervising the planning and construction of silos.

The Land Bank has granted loans to date to the amount of R303 million for the construction of grain silos for co-operatives and mills; this represents a total of 10 million tons of storage capacity. At present about R50 million is made available for this purpose annually. It is estimated that approximately an additional R250 million will be required to provide future needs.

During the past year the erection of 10 new and extensions to 15 existing silos were started. This will increase the storage space by about 1,5 x 10⁶ tons.

Glasshouses and other climate-controlled structures: The Division not only draws up plans

and specifications of climate-controlled structures for the various Departmental institutions, but also provides technical assistance and advice to other Government departments and various private bodies. During the past year new glasshouses were erected at the Small Grain Centre at Bethlehem and at the Citrus and Subtropical Fruit Research Institute at Nelspruit, and existing glasshouses at the Horticultural Research Institute, at Potchefstroom and at the experimental farms at Addo and East London were enlarged. The units were renovated in the process and mechanical cooling was introduced. From the 1982/83 financial year onwards there is a prospect of an annual allocation of over R750 000 for glasshouses, which will have to be maintained for at least the following three to four years if the necessary glasshouse facilities are to be introduced at new research centres.

The professional services the Division renders to Departmental research institutions cover the entire field of agricultural mechanisation, irrigation and farm buildings, which includes the design and making of special research equipment and special implements - for which the demand is still increasing.

SOIL CONSERVATION

SOIL CONSERVATION RESEARCH

The soil conservation programme of the Division of Agricultural Engineering was continued; it involves mainly the following:

Rainfall simulators: During the past year the value of 3 rainfall simulators, completed the previous year, was clearly evident.

Following the example of researchers in the USA and other Western countries, several researchers and extension officers throughout the country used the simulators firstly to determine soil properties and norms for various soil conditions with regard to erosion control and irrigation practices and secondly to serve as a visual demonstration aid for transmitting technology and for the purposes of extension work.

The simulators were used at at least 30 localities, including 12 in Natal, three in the winter rainfall area, a few on the Springbok Flats and certain irrigation areas in the Free State and maize lands in the Western Transvaal. Simulators were also used at a farmers' day at Morgenzon, which was held at the agricultural high school.

Interesting facts, and facts which suggested new approaches, emerged regularly. For instance, the trials on the sloping pineapple fields in the Eastern Cape illustrated the nature of erosion so strikingly that entirely new approaches to conservation measures followed.

The matter is still being investigated.

The value of surface cover, either in the form of plant cover or in the form of a mulch, in preventing erosion and reducing run-off, is

probably the most important factor to be regularly shown up by the simulators.

Donga reclamation: The six registered projects concerned with reclaiming dongas and severely eroded hollows and with follow-up action and utilisation of the reclaimed areas were continued. The section concerned, at Aliwal North, submitted a comprehensive but compact annual report which can be regarded as an informative progress report as well. It contains valuable information.

SOIL CONSERVATION WORKS

The subdivision at Aliwal North, which is responsible for the planning, design and construction of State soil conservation works, completed seven new works during the year under review, to the value of R115 000; repairs to the value of R115 000 were carried out on 18 works. All the works are situated in the Orange River catchment. During the previous year 10 works to the value of R600 000 were completed and 18 works repaired at a cost of R112 000.

In all about 332 similar State works have been completed on private farms since the Soil Conservation Act came into operation in 1946. This is in addition to the approximately 200 works erected on State land in various parts of the country.

The productivity of the Subdivision and the physical work done by it in the execution of its task are reflected in the following table.

WASTE HANDLING

Intensive animal feeding systems in South Africa compare well with the best in the developed world and lend themselves to the application of the same waste handling systems as elsewhere.

If the percentage of animals in South Africa kept under wholly intensive conditions is compared with those for the United States of America and Europe a considerable expansion in the numbers of dairy and beef cattle kept under wholly intensive conditions in South Africa can be expected in the foreseeable future.

Most of these intensive systems are situated far from inhabited areas, so that environmental pollution is not really noticeable. Some, and especially the smaller ones, are situated near the boundaries of or even within urban areas and cause odour and fly problems. In some cases the urban area is encroaching on the agricultural area and is pushing out these intensive units, which find it difficult to comply with the health and anti-pollution regulations imposed by the local authorities.

In general the farmer who keeps animals in intensive feeding systems is aware of the dangers and problems that can be caused by waste pollution and does his best to deal with and use the waste in such a way that a nuisance is avoided. However, there are parts of South Africa where pollution does take place; the most obvious cases occur in the winter rainfall area, where dairy cattle, especially, are penned next to open streams and no provision is made for controlling effluent to the streams.

The use of wastes

Most farmers try to use the waste from intensive feeding systems advantageously, either by spraying it directly onto the land or by selling it or in some places even by feeding it to the animals again (ruminants). This is especially true of broiler manure, which is an important constituent of the rations in many cattle feeding systems.

Methods of handling

A few years ago there was a tendency among farmers to spend large sums on waste handling equipment, in many cases against the advice of the Division. This machinery is now largely worn out owing to the corrosive properties of animal waste, or is no longer used, and the tendency now is to use as little machinery as possible. The use of anaerobic lagoons for storage and partial treatment of wastes has become very popular and is recommended by the Division wherever possible.

The part played by the Division

The waste handling problem in the Republic is under control at present, and enough knowledge is available to deal with the increasing demands for information and guidance. At the moment only the farmers who request advice or who are threatened with prosecution are advised.

Regulations on the control of intensive animal feeding systems are being drawn up, and according to these regulations each intensive feeding system accommodating over a certain number of animals has to be registered and will then have to comply with certain requirements.

The Division has available a number of publications on the handling, treatment and use of animal wastes. These should be of great assistance to the farmer and in some cases should provide guidance which will make it possible for the farmer to solve his waste problems himself.

Year	Soil exca- vations m ³	Earth moving m ³	Rock exca- vations m ³	Con- crete m ³	Gravel m ³	Gabions m ³	Fences erected km
1979/80	71 749	74 158	50	10 210	9 561	180	24,6
1980/81	63 979	110 526	38,7	7 479	18 970	1 758	55,3

TRANSMISSION OF TECHNOLOGICAL KNOWLEDGE

The Division of Agricultural Engineering undertakes both research and information services (transmission of technological knowledge). The provision and distribution of suitable publications for farmers and other clients is receiving high priority. Consequently about 180 pamphlets and related publications on agricultural engineering subjects, including 50 test reports, have appeared since 1973. During the past eight years the demand for publications containing advice on agricultural engineering has increased from an average of 600 to over 22 000 a month.

Short courses, demonstrations and lectures presented for farmers, agricultural extension officers and other clients have increased to such an extent that during the past year 29 courses of an average length of about 1 day and with a total attendance of over 720 persons, were presented. (The total figure for the past three years is 165 courses, with a total attendance of over 4 000 persons.) During the same period about 270 lectures and demonstrations were presented at the request of regional organisations and were attended by a total of 4 700 persons. (The total figure for the past three years was 650, with a total attendance of 18 600.) Two successful ten-day courses were also presented to agricultural officers of the Prisons Service during the year under review, one at Sonderwater Prison and two at the Victor Verster Prison in the winter rainfall area.

The teaching of agricultural engineering subjects at five colleges of agriculture is also co-ordinated by the Division. Since 1977 guides on 11 related subjects have been compiled, and two are in the process of compilation. In all this amounts to about 1 100 pages of 400 words each.

Another striking example of the successful imparting of technological knowledge, occurred in SWA during the year under review. Because farmers suffer exceptionally high losses to their sunflower crops, which are eaten by swarms of birds that cannot be controlled, they are compelled to combine while the moisture content is still between 35 % and 40 %. Practical drying plants had to be designed at the request of the SWA Administration to reduce the moisture content of the sunflower seed to the desired 8 %. A simple locally adapted system was designed by an officer of the Division; it operates very economically and is now being generally constructed.

STATUTORY CONTROL

SUBDIVISION STATUTORY CONTROL EXPANDS INSPECTION SERVICES

The Subdivision Statutory Control of the Division of Technical and Legal Affairs is responsible for the administration and

implementation of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947). Under this Act the inspection services were expanded by increasing the number of agricultural legal inspectors from one to 12 from 1 April 1980. This expansion became necessary because at present about 12 000 remedies are registered under the Act. The turnover for these remedies comes to R1 200 million per year.

The following statistics give an indication of the activities of the Subdivision:

Registrations handled			
Sterilising installations			89
Fertilisers			2 963
Farm feeds			5 951
Agricultural remedies			2 858
Stock remedies			798
Total			12 659
Inspections carried out			
Province	Number of inspections	Warnings issued	km travelled
Transvaal	449	1 476	93 462
Cape	1 125	419	85 351
Natal	343	1 372	34 800
Total	1 917	3 258	213 613
Samples taken			
Lime			66
Agricultural and stock remedies			660
Farm feeds			1 312
Total			2 048

Five offenders were prosecuted, and 253 warnings were issued after analysis of samples taken proved that products did not meet the specified requirements.

BIOMETRIC AND DATAMETRIC SERVICES

During the year this small section, having developed from the former Biometry Section two years ago, more than doubled its staff complement and is now able to make a valuable contribution to the overall activities of the Department, mostly in the service field. A number of subsections, with separate objectives, have been created and it is anticipated that each will be strengthened in due course. In addition to staff at Headquarters, a number of professional officers and technicians are stationed in the Regions, where they provide essentially the same services to their colleagues as the staff at Headquarters.

The oldest subsection, Biometry, is concerned with research into biometric methods and advises agricultural researchers on biometric and statistical matters; including the design of experiments. Particular attention is paid to modelling, in the broadest sense, evaluation of cultivar trials, multivariate methods and regression analysis.

The Scientific Systems Subsection assists the Regions and Institutes with the planning and implementation of scientific systems. An automated, computer-controlled laboratory which is being commissioned for the Citrus and Subtropical Fruit Research Institute and a system which is being investigated for the Tobacco Research Institute's laboratory are examples of the subsection's recent activities.

The National Data Banks Subsection has been concerned with developing a pilot land-use inventory data bank for the Department and has contributed towards the planning of a future norm-ecotope data bank. The Botanical Research

Institute has been assisted with the refinement of their herbarium data bank. A vinothèque data bank was developed for the Oenological and Viticultural Research Institute.

The *Ad Hoc* Tasks Subsection continues to maintain and add to the computer program library and has undertaken many computer processing tasks of varying size and complexity for research officers, both within and outside the Department. This subsection is also responsible for the very important education and training functions of the Section.

15. Sea Fisheries

INTRODUCTION

The most important occurrence during the year was probably the transfer of responsibility for fisheries from the Department of Industries to the new Department of Agriculture and Fisheries as from 1 April 1980.

Another important event was the launching in Durban on 21 November of the new large research vessel by Mrs C.J. du Plessis, wife of the Minister of Agriculture and Fisheries.

The Commission appointed to investigate certain aspects of the fishing industry completed its deliberations during June and a report on its findings and recommendations was published.

The activities of the Institute are still being hampered by the fact that it is not housed in a single building but spread all over Cape Town. During the year, further disintegration occurred when the Director and the administrative staff moved to central city offices, leaving the Sea Point complex to the scientists. The accommodation problems of the Institute may, however, be solved in the near future, since a site has been obtained in the Milnerton municipal area and planning for a new building to house the entire staff is to start shortly.

The continued shortage and further loss during the year of Fisheries Inspectors (there is now a shortage of 20 per cent) is alarming and there is no need to enlarge on the serious implications of this shortage if the position is not rectified in the immediate future.

COMMERCIAL FISHERIES

Seaweed industry

This past year has witnessed the advancement of two local enterprises that process seaweed raw materials, the one using *Gelidium* and *Gracilaria* species to produce agar extracts and the other fresh *Ecklonia maxima* to produce a product for treating agricultural crops.

Exports of dry unprocessed seaweed have been negligible, amounting to only 380 955 kg of *Ecklonia*.

Bait industry

In 1980 there were 20 licensed bait collectors, supplying some 80 distributors between Melkbos on the West Coast and East London on the East Coast with white mussels, red-bait and octopus. Collection of all organisms dropped in comparison with 1979.

Oyster industry

The number of permits issued to oyster-pickers was reduced from 207 in 1979 to 203 in 1980. The number of oysters of legal size collected intertidally increased by 14 per cent to 630 196, and the number of oysters cultivated at Knysna and Langebaan increased by 24 per cent to 1 655 519.

Abalone industry

While the production quota was maintained at the same level as that for the previous year (163 300 kg), the number of licensed divers decreased from 66 to 58. The catch per unit of effort increased from 93,2 to 96,7 kg per hour.

Cephalopod industry

As a result of the virtual cessation of activities of the South Coast rock lobster industry where octopus formed an important by-catch, only 31 607 kg of octopus was landed in 1980, compared with 105 573 kg in 1979.

Recorded squid landings amounted to 1 751 tons, compared with the 2 694 tons of 1979.

Crustacean fisheries

West Coast rock lobster

The production quota for the 1979/80 season remained at 1 612 250 kg tail mass, but a landed weight quota of 5 642 870 kg was also introduced to allow better control over the actual quantity of rock lobsters caught and landed.

Catches from areas north of St Helena Bay remained low and fishing effort continued to shift to the southern fishing grounds. Catch rates on all fishing grounds (except the Cape Peninsula) declined, especially at Dassen Island. As a result, it was decided that the 1980/81 quota should be reduced by 15 per cent, that fishing at Dassen Island should only start on 15 November and that not more than 800 tons should be caught at Dassen Island.

South Coast rock lobster

The total production of *Palinurus gilchristi* off the South Coast in 1979/80 amounted to only 121 763 kg tail weight, compared with 460 844 kg in 1978/79.

Catch rates declined in most areas and the total effort expended was very much lower (only about 25 %), since fishing vessels were diverted to tuna fishing in the early months of the season.

East Coast crustacea

Landings of East Coast crustacea increased appreciably from 1979 to 1980: prawn catches by 30,5 per cent, langoustines by 54,5 per cent and crab by 138,1 per cent.

Pelagic fishery

Catch

The pelagic quota, set at 380 000 tons in 1977, remained unchanged. Anchovies contributed 85,5 per cent of total landings but pilchards only 11,3 per cent and round herring 3,2 per cent.

Production

There was a slight increase in the amount of meal produced but oil production dropped by about 7 000 tons. As a result of greater production at the Gans Bay factory, the amount of pilchards canned increased by almost 50 per cent, but the canned mackerel production decreased appreciably. Apart from the 2 516 tons of pelagic fish caught by the specially licensed bait boats, a further 667 tons of the pelagic quota was used for bait.

Fishing fleet

The total hold capacity decreased from 9 332 tons in 1979 to 8 881 tons in 1980, reflecting a decrease from 93 to 89 boats. A further 54 boats were licensed to catch pelagic fish for bait.

Line fishery

It is estimated that over 10 000 tons of line fish, excluding snoek and tuna, was landed. The catch of 679 000 snoek was the lowest on record. The tuna catches were not as high as for 1979 and only 540 tons of yellowfin, 422 tons of bigeye, 50 tons of skipjack, 13 tons of bluefin, 9 tons of bonito and 32 tons of swordfish and marlin were landed.

Line fisherman caught 595 tons of sharks, which were used to produce frozen meat, salted and dried meat and some biltong.

Harder fishery

Harder landings increased by 59 per cent to 9,1 million, mainly as a result of larger catches made in most areas except those north of Elands Bay and east of Still Bay.

Demersal fishery

Commercial landings of demersal fish decreased by some 8 per cent to 200 711 tons (live weight) with a value in excess of R140 million. Hake catches dropped by 5 per cent, maasbanker by 32 per cent, mackerel by 47 per cent and panga by 86 per cent. Trawled snoek catches, however, increased by 54 per cent, jacobever by 93 per cent, John Dory by 28 per cent and monk by 4 per cent.

Four foreign countries were still allowed to take small quotas of nominated species within the

320 km exclusive fisheries zone. Of the total hake quota of 152 000 tons in South African waters, South African fishing companies were granted 141 850 tons, of which 7 000 tons, later increased to 9 000 tons, went to the inshore industry. The Agulhas sole quota, set at 900 tons, was completed before the end of October.

During the year 5 807 tons of whitefish meal was produced on land and 1 839 tons at sea.

Sealing industry

Possibly because of low market prices for seal skins, harvesting took place at only three colonies and only 18 666 pups were taken, which is much less than the 27 308 in 1979. Only 547 bulls were shot at Seal Island, False Bay. Blubber and carcasses yielded 27 675 kg of seal oil and 12 tons of meat meal.

Guano collection

Although no collection took place at four islands, the other four yielded 3 284 tons of guano, with an additional 722 tons from the Bird Rock platform at Walvis Bay.

RESEARCH

Research vessels

The five research vessels remained active throughout the year and covered a total of 54 021 nautical miles during 603 days at seas. The Institute's new research vessel, *Africana*, was officially launched on 21 November and is due for delivery late in 1981 or early in 1982.

Hydrography

The past year has seen the building up of a new generation of equipment for thermohaline and current measurement. Some of the research going on is mentioned briefly below:

Cape upwelling experiment

Some preliminary results of this experiment were presented in a paper which pointed to the effect of bottom topography in initiating upwelling around the Cape Peninsula, the effect of the strong spatial and cyclic temporal variability in the wind field and the presence of what appears to be a jet steered by the Cape Point Canyon onto the shelf.

Attention was also given to other components of the physical work, including the analysis of thermistor data to determine internal wave motions and water column stability, a theoretical analysis of the FGGE Buoy track in terms of the effect of topography on vorticity of the water column, and some others.

Moored current meters

The first mooring of a current meter in the Cape Point Canyon showed that the water flow is jetlike, showing a reversal on the time scale of

passing eastward-moving cyclonic airflow, but with no exact phase relationship. The pressure sensors indicated that there is a long-period fluctuation in sea-level of the order of days, with an amplitude of perhaps 10 cm.

The current-meter programme will be extended and three types will be used, namely, the simple Savonius rotor type, an acoustic and an electro-magnetic type. Further technical training of staff in such matters as marine metallurgy and electronics is essential to the programme.

Wind at coastal stations

Automatic coastal weather stations are at present situated at Danger Point, Olifantsbos, Oudekraal, Stompneus Bay and Hondeklip Bay. Data from these stations are used to produce progressive vector diagrams of wind and time series of pressure and temperature which may eventually be correlated with single biological parameters.

Airborne radiation thermometry and wind measurement

A twin-engined aircraft was again chartered for work between Cape Agulhas and the Orange River during February, October and November. A montage of sea surface temperatures was constructed for the entire West Coast for the early stages of the wind event cycle. Strong plume-like features of cold surface water are clearly shown. The oceanic front is wide west of Cape Town, narrows west of Cape Columbine, widens to nearly 100 km west of Lambert's Bay and narrows to 20 km at Hondeklip Bay. This work represents the first systematic attempt to obtain a synoptic picture of West Coast upwelling and to relate surface temperature to wind.

Winds at a height of 150 km are measured from aircraft drift, a true airspeed indicator and Decca navigation. Considerable light has been thrown on the behaviour of the wind field under different meteorological conditions. Several spiral ascents were also flown up to 500 m to determine the heights of inversion layers and temperature gradients under various conditions.

Wind measurement at sea surface

Surface wind stress is of great importance to small-scale oceanic features up to 10 km in extent. A stable platform free from obstruction is required to estimate wind stress from the cross correlation of velocity from a stochastic sampling acoustic anemometer. Much of the past year was spent in the design and building of equipment for this project, together with reviews of theoretical work.

Low-oxygen water

In order to make an in-depth study of the low oxygen phenomenon on the West Coast, a start was made with the analysis of sediments and interstitial water.

A project was also started to monitor the heart and scaphognathite rates of the rock lobster in the presence of low-oxygen water. It was confirmed that the presence of sulphide is the cause of rock lobsters leaving the water, as occurred at Elands Bay. Research on this aspect is continuing.

Satellite surface truth

A highly successful Nimbus-7 experiment was executed in February in collaboration with the National Research Institutes of Oceanography and of Physics of the CSIR and scientists from EURASEP, Ispra Establishment, Italy. Valuable surface-truth data were collected and partially processed.

Environmental pollution

To test the effects of factory effluents on the water quality in Saldanha Bay, a number of environmental parameters were measured quarterly at 10 stations. Elevated levels of organics in the harbour, especially during summer months, were shown to result from the effluents discharged by the fish factories in the harbour. Drogue studies are also carried out to establish the altered current regime resulting from the construction of the ore jetty. A programme was established to determine hydrocarbon levels in the water, sediment and biological material in the bay.

The long-term monitoring in Saldanha Bay of some heavy metals in the water, biological material and sediments continued. A review of the metal concentration over a five-year period indicates that these levels have not increased significantly.

It was found that the levels of Fe, Zn, Cu and Mn were significantly higher in the sediments of two stations close to the ore-loading jetty.

As it was decided that indicator species are essential to obtain a more precise reflection of metal levels in the bay, black mussels and oysters in net bags were placed at five sites around the bay. Mercury in the body tissues of hake and kingklip was also measured.

Oil research

The research aquarium for oil pollution has now been completed and tests are being conducted to obtain maximum solution of the test oil in sea-water. In the mean time static toxicity tests have been conducted on various life stages of the sand prawn. Larval and juvenile stages have been shown to be most sensitive but the eggs are fairly tolerant of exposure to oil.

A closed static aquarium system for toxicity testing has been developed by which all dispersants available in South Africa will be tested and ranked according to toxicity. The sand shrimp will be used in these tests.

A baseline survey to identify principal and key species and to obtain an estimate of their relative abundance at various sites was undertaken. These data will be used if an ecological assessment

should become necessary following coastal contamination through an oil spill.

Biological oceanography

Phytoplankton

In a study of seeding and colonisation of newly upwelled water, the phytoplankton species present during the December 1979 drogue study were identified, counted and sized. The three species that dominated in the newly upwelled water remained dominant during all five days of the study despite great changes in the light and nutrient levels.

The development of a phytoplankton bloom in a single mass of freshly upwelled water was followed on two occasions. Phytoplankton multiplied rapidly, as indicated by the chlorophyll content of the water. Protein synthesis increased steadily during both the day and the night, to reach the highest concentrations just prior to the peak of the bloom. Carbohydrate synthesis increased rapidly during the day but decreased during the night.

Studies on the patterns of carbon assimilation into the major end-products of phytoplankton photosynthesis, using radio-active bicarbonate as a tracer, were conducted during the year. It was found that the assimilation of carbon into polysaccharide fractions was high in the upper euphotic zone but much lower at the bottom of this zone.

Red-water

Several mortalities of white mussels occurred at Eland Bay owing to a bloom of the toxic dinoflagellate, *Gonyaulax catanella*.

Zooplankton

A paper on the consistency of planktonic food for pelagic fish showed that patches of plankton developed and moved more erratically in the Cape Peninsula upwelling area than further north.

Particle spectra in transects normal to the coast off the Cape Peninsula were made in November in conjunction with vertical distribution studies of pelagic fish eggs and larvae, as part of an investigation of the distribution of potential food items for larvae.

The seasonal cycle of zooplankton in the St Helena Bay area was investigated by analysing samples on one of the transect lines. Preliminary grouping analysis showed a very uniform, consistent population in terms of both numbers and biomass along the whole transect.

The study of plankton dynamics by means of drogues showed remarkably rapid changes in the level of stocks, nutrients and light. Preliminary studies also indicated that rapid growth rates of phytoplankton persisted until the fourth day, when the stationary phase began, owing to light and nutrients becoming limiting factors in the upper mixed layer.

Southern Ocean research

The Sea Fisheries Institute's Southern Ocean research programme is funded by the CSIR through its Committee on Oceanographic Research and contributes to the international BIOMASS programme. It specifically leads to participation in FIBEX, a major international co-operative study on krill.

In February/March the Institute conducted a krill research cruise, concentrating on the sector 0-30°E, between 52°S and the edge of the pack-ice. Hydro-acoustic methods of detecting krill swarms and assessing their size, shape and density were tested in preparation for FIBEX. Seven foreign scientists from four different countries participated in the cruise.

Acoustic and biological data collected on the cruise were submitted to the Fachbereich Informatik, University of Hamburg, Federal Republic of Germany, and used extensively by them to develop and test a data base for the international exchange of data to be collected during FIBEX.

As a further commitment in the Southern Ocean, the Institute participated in cruises to Marion and Gough Islands in May and October respectively. The work comprised studying the distribution and abundance of macroplankton and micronekton in the vicinity of the islands, by means of hydro-acoustic and biological sampling techniques.

Seaweed

The main thrust of the research continued to be directed to management techniques for kelp stocks. The kelp involved are *Laminaria pallida*, *L. schinzii* and *Ecklonia maxima*, all large brown seaweeds that occur on the West Coast and eastwards as far as Cape Agulhas. Traditionally, commercial needs of these weeds are met by collecting what has, through natural processes, been cast ashore. However, the export of dried kelp has all but ceased as a result of a drop in market interest, and the local seaweed processing industry needs fresh, wet kelp for its product. As a result of the experience gained through experiments and stock assessments, it was proposed that a small commercial harvesting programme be implemented for one year. Whereas in the original harvesting programme cutting of all kelps with stalks longer than 250 mm was permitted to progress over an uninterrupted area, the new programme will permit the removal of *Ecklonia maxima* alone from discrete bands about 10 m wide and separated by at least three times their width. During the course of the first harvesting programme, 275 tons of wet stipes (stalks) of *Ecklonia maxima* were harvested from an area of approximately 5,4 ha.

Experimental evidence shows that original biomass is restored four years after harvesting all *Ecklonia* stipes longer than 250 mm. Also evident from previously acquired data is that there is no

significant perturbation of the biological components of the kelp-bed community.

Research into kelp stocks occurring north of Cape Columbine shows that the communities are different from those further south. *Laminaria schinzii*, a species apparently absent elsewhere, appears to dominate the kelp beds of St Helena Bay and northwards. Because they feature a hollow stipe similar to that of *Ecklonia maxima*, *L. schinzii* plants, unlike *L. pallida*, float when detached by surf action and eventually fetch up on the shore. This explains why it is that alginate yields from kelp from areas north of St Helena Bay have always been lower than from southern coast kelps that have almost a 100 per cent *Ecklonia maxima* component in beach-casts. *Ecklonia* yields as much as 35 % of its dry weight as alginate where *Laminaria* has about 25 %.

Also evidenced by studies on *L. schinzii* is the pattern of slow frond lengthening in winter and maximum elongation just before the height of summer discovered in both *L. pallida* and *Ecklonia maxima*. Also characteristic is the constant erosion of material at frond-ends. Fronds produce up to six times their own weight in a year with no apparent growth, and the larger the blade, the greater is its relative output. By the use of techniques devised in the Seaweed Subsection to assess standing stock, it has been estimated that there are about 500 000 tons of kelp growing between Cape Columbine and Port Nolloth.

June and July appeared to be the peak sporing months, although reproductive tissue was present on the fronds throughout the year, provided the plants concerned had stipes longer than 1 m. Shorter plants were not reproductive.

Red-bait

Research involves monitoring the recovery of three sites which were cleared of red-bait in 1974. They have shown a remarkably slow rate of recovery, none having yet returned to a state comparable with that of the uncleared surrounds. This appears to be due largely to mortality of the newly settled red-bait pods.

Molluscs

White mussels

After reports of a mass mortality of white mussels at Elands Bay in March, a survey was carried out of the surviving population. Although a reasonable breeding stock had survived, an absence of small mussels indicated a recruitment failure over the last one to two years. Provided that future recruitment is successful, the population should recover to previous levels over the next six to seven years.

Abalone

Research was primarily aimed at developing a simple and efficient abalone survey technique, at the same time gaining insight into the population

dynamics of a commercially unexploited population at Betty's Bay (H.F. Verwoerd Coastal Reserve).

Population densities were found to be greatest in the depth range from zero to five metres, with figures as high as ten per square metre. Densities rapidly decreased below the depth of 5 m, until virtually no abalone were found in the 15 to 20 m depth range. Because recruitment occurs primarily in shallow water, the mean size of abalone increases with increasing depth.

Analysis of divers' catch returns for the last four years has shown that, on average, 70 % of the total catch has come from three areas, namely the Hangklip area, the Hawston/Onrust area and the Gans Bay/Danger Point area.

The improvement found in the overall C.P.U.E. for 1980 is not as encouraging as it might appear, since this has been due largely to a shifting of fishing effort to the more remote areas such as Pearly Beach (near Dyer Island) and Quoin Point.

Squid

Following reports of increasing interest in squid by the industry owing to the increased demand for this cephalopod both locally and overseas, a new research programme was initiated in January.

Squid was sampled regularly at Cape Town and Mossel Bay wetfish docks in an attempt to build up a picture of their biological cycles, availability and growth rates.

During November and December, a joint research cruise with two Japanese research institutes was undertaken with the aim of estimating the distribution and biomass of squid on the South Coast and studying biological cycles and mesh selectivity.

Two locally based companies are planning test fishing operations throughout 1981, using mainly jigging and light attraction. The area where the operations are carried out will include the South Coast.

Rock lobster

West Coast

In January and February diving surveys were conducted at the important Saldanha Bay/Cape Columbine fishing grounds to investigate rock lobster size distribution, biology and the benthic environment in two areas where growth rates of rock lobster populations differed greatly.

An intensive research programme was also undertaken at Dassen Island. In April, approximately 10 000 rock lobsters were tagged with the aid of commercial vessels hired for this purpose.

During May the industry made available five fishing vessels to conduct a trap-fishing survey in the Hondeklip Bay region between the depths of 5 and 120 m. This survey showed conclusively that rock lobsters were not found in deep waters in any considerable quantities.

An experiment was designed to test the effect of varying mesh sizes on rock lobster traps. Preliminary indications are that increasing the mesh size above that at present used would considerably reduce the number of undersize rock lobsters caught by commercial traps.

South Coast

Cruises were conducted during May and June in an attempt to recapture previously tagged specimens of *Palinurus gilchristi* at Rocky Bank. Unfortunately, catches were so poor in both months that no worthwhile information could be obtained. It is possible that stock density had been much reduced by unreported commercial fishing activities earlier in the year.

Pelagic fish

Examination of commercial landings

Four field stations were again operated during the season, namely at Sandy Point, Saldanha, Hout Bay and Gans Bay. The Lambert's Bay inspectorate provided information on catch compositions and length frequency distribution.

Pelagic stocks in general

In October a scientist visited the National Research Institute for Mathematical Sciences (Pretoria) to discuss final details concerning the linear model programme. The simulation model was used to predict the long-term yield from the pelagic resource, given average recruitment and environmental conditions.

A number of papers were submitted for publication in both internal and external journals. One of particular importance discussed seasonal patterns in South Africa's Western Cape purse seine fishery. Another paper considered the effect of adverse egg and larval drift on anchovy recruitment.

Research into the use of seabirds as indicators of changes in fish stock biomass continued. Cape cormorant and gannet chicks were ringed on a number of islands and a third complete aerial census was conducted.

Yellowtail

Yellowtail samples were collected from landings at Kalk Bay, Hermanus and Struis Bay. The yellowtail growth experiment using captive fish injected with tetracycline was brought to a close and plans were made to continue the experiment on fish in the wild.

Other line-fish

Data on line-fish in False Bay, especially on feeding, were collected and processed to obtain information on the relationship between angling fish and pelagic shoal fish in the Bay.

Samples of commercial landings of snoek were examined to obtain information on condition, sizes and feeding habits.

Tuna catch-and-effort statistics were collected from local fishermen. Samples of longfin and bigeye tuna caught by local boats were measured, as well as samples from 105 Taiwanese longliners transhipping 11982 tons of tuna in Table Bay docks.

Demersal fish

Field work and monitoring

Great emphasis was placed on the examination of commercial landings during the year; there was a particular increase in the sampling of species other than those of major commercial importance. Most of the measured fish were derived from commercial catches made between the Orange River and just east of Mossel Bay.

Four cruises were undertaken on board commercial trawlers, with the specific aim of collecting length frequency information. In addition, three research-orientated commercial cruises were undertaken. Two of these entailed the use of two similar ships fishing in the same area at the same time but using different effective mesh sizes in their cod-ends. The other research-orientated commercial cruise was a feasibility study on maasbanker availability east of Port Elizabeth and entailed the use of three inshore trawlers for one week each.

Routine collection of otoliths resulted in 1 278 hake being analysed for age, and monk and maasbanker otoliths were collected for future analysis. A further 600 hake otoliths were collected during a biomass evaluation experiment for squid.

Routine monitoring of catch-and-effort data for all demersal species continued. The catch per unit effort for hake on the grounds close to Cape Town showed little change from that of the previous year.

Seven research cruises were undertaken, two to the hake trawling grounds west of Cape Town, two to the hake grounds between latitude 30°S and longitude 20°E to study the recruitment pattern, one to the grounds between longitudes 20 and 25°E (curtailed because of technical problems) to determine recruitment levels of hake on the South Coast, one to the sole grounds off Port Nolloth and one to a variety of Cape hake grounds to study mesh selection by means of the "trouser cod-end technique".

Stock assessment work on the Cape hake species continued along the lines already established. Virtual population analysis of the catch information indicated that another fairly strong year-class (that of 1978) was entering the fishery in ICSEAF Division 1.6 after the relatively weak year-class of 1977.

Two studies of the effects of different mesh sizes on hake catch rates were conducted, one using commercial trawlers fishing side by side and the

other making use of the "trouser cod-end" technique.

A start was made during the year on evaluating the cannibalism rate of hake. This study, part of a general feeding study of the species, will, it is hoped, aid in the determination of a more realistic value of *M*, the natural mortality, for use in stock assessments.

Sole

Biological studies, aimed at improving the stock assessments, commenced. Included in these studies was a pilot attempt at tagging the species with Petersen disc tags. Initial results were promising. The annual standing stock survey on West Coast sole off Port Nolloth confirmed that recovery of the stock will be a slow process.

Other species

Only limited research was carried out on other species. Information on maasbanker was collected and will be evaluated at a later stage. Preliminary biological information on monkfish (anglerfish) *Lophius piscatorius* was collected and will be analysed in detail in the future.

Marine mammals

Whales

The Marine Mammal Subsection participated in the second cruise to assess the stocks of *minke whales* in the southern hemisphere. Two Japanese scouting vessels again undertook a systematic marking and sighting cruise, this time in Antarctic Area III (0 to 70 °E). During the cruise 710 minke and 5 sperm whales were marked.

The annual *right whale* survey was carried out between 25 and 26 September, over the regular survey area from Muizenberg to Woody Cape, Algoa Bay.

An analysis of the 11 annual surveys since 1969 gave a significant rate of increase of 7 per cent a year.

The catch per unit effort of *sperm whales* at Durban from 1954 to 1975 was reassessed, using time budget data. There was an overall decline in the abundance of large males only, and the abundance of small males and of females increased significantly.

Seals

All fur seal colonies in the Republic were photographed from the air in December for counts of the number of pups present. A manuscript dealing with historical levels of seals and seabirds on islands off Southern Africa was accepted for publication as an *Investigational Report*.

Scientific co-operation

As a result of the accelerated interest of many nations in the Antarctic, the Director had to attend a meeting in Australia where the living

marine resources of that region were discussed. One of our scientists also participated in a BIOMASS workshop and SCAR/SCOR working party on the estimation of krill abundance in the Antarctic and a further meeting in France where future surveys were planned.

The Institute co-operated with a number of national and international bodies in the planning and execution of marine research programmes in the Southern Ocean. In February/March, the Institute conducted a research cruise to the Antarctic on the M.V. *Agulhas* (owned by the Department of Transport) to study krill. The programme was carried out in co-operation with the Department of Oceanography of the Texas A and M University, U.S.A., the National Research Institute of Oceanology and the University of Cape Town and was funded by the CSIR through SANCOR.

As always, the International Whaling Commission required attendance by the Institute at a few meetings: one in London during July, a special meeting in New York in September and a meeting in Tokyo where the IDCR research cruise was planned.

During September, a scientist attended a meeting of the London Dumping Convention of IMCO, and another took part in the International Seaweed Symposium in Sweden.

In December, the Director and three scientists travelled to the annual meeting of the International Commission for the Southeast Atlantic Fisheries in Mallorca.

During the period of 20 December 1979 to 22 February 1980, a Principal Technician of the Institute, together with five other researchers from four other countries, accompanied two Japanese scouting vessels on a very successful systematic marking and sighting cruise to assess the stocks of minke whales in the southern hemisphere in Antarctic Area II (0 to 70 °E).

ANCILLARY SERVICES

Library

During the year the library acquired 122 new books, 35 new charts, and received 2931 periodicals. These accessions bring the library stock to 3 240 books, 1 162 periodical titles (of which 661 are current), 118 works on microfiche and 533 charts and maps.

During the year the library staff compiled a bibliography of all the Institute's publications printed from 1896 to 1979.

Electronic data-processing

This year has been one of the most successful the Section has ever had in providing a computer bureau service intended solely for scientific users.

The in-house mini-computer continued to function excellently and has surpassed expectations, and about 50 per cent of the work is now being disposed of in-house. The text processing facility

supplied for the Institute's editor has also proved very useful.

Using a consultant from the private sector has proved a great success, and he was used in such a way that his responsibilities made him part of the Section and involved him totally in all planning and work.

Numerous educational courses were attended by staff members. All programmers attended a 5-day course entitled "Program in Style". This course mainly explained the structured approach to data processing. Four programmers and the operator attended a 10-day course on the efficient use of the Eclipse S/130 system and its software. Various courses, presented by the University of Cape Town, were attended by staff members.

Workshops

The steady development of the two scientific workshops came to an abrupt halt during 1980 owing to the acute nation-wide shortage of engineering skills. This is a very serious problem for the future of the projects which depend on this equipment.

Mechanical

Despite the critical staff shortage, the quality of instruments developed by the combined workshops continued to improve. Major development projects undertaken during the year include:

- (1) Improvements to the Bongo net monitoring unit.
- (2) Further developments to the remote control system of research midwater trawl nets.
- (3) Acoustic timer/marker unit for Southern Ocean krill research.

Scientific electronics

Planning for the arrival of the new deep-sea research vessel *Africana* continued. A serious setback was that the posts requested for maintaining equipment on *Africana* had not been created by the end of the year.

Fishing gear

This unit has performed well during the year and has undertaken the manufacture, repair and maintenance of a large quantity of fishing gear. The bulk of the work has involved trawling and rock lobster equipment.

Marine electronics

A very difficult year was experienced by this small unit. This was due mainly to the fact that the post vacated by the late Chief Technician remained vacant throughout the year. It was necessary, therefore, to resort increasingly to the employment of agents and contractors to carry out repairs.

16. Subsidies and assistance

Subsidy on Group II fertilisers

The subsidy on agricultural lime and gypsum was extended with effect from 1 January 1981 to include the following liming materials: Calcium silicate, calcium oxide of slaked lime, calcium hydroxide or quicklime, magnesium oxide and magnesium hydroxide.

During the year under review R5 980 638 was paid out in subsidies on the above-mentioned liming materials and a sum of R4 732 836 was paid in subsidies on agricultural lime and agricultural gypsum during the previous year. At R4 per ton this represents an increase of about 314 000 tons of liming materials on which a subsidy was paid.

Subsidy on stock feed

The stock feed subsidy scheme was extended to a number of additional areas as a result of the continued drought during most of the year under review. In addition, the following adjustments to the existing schemes were made:

From June 1980 the subsidy in drought disaster areas was increased from 50 % to 60 % and the number of livestock from 1 000 ewes to 1 200 breeding small stock units.

From 1 December 1980 onwards stock feed loans for large stock were increased from R10 to R12 per month and a subsidy of 50 % introduced as third phase assistance for wards 7, 9 and 10 of the Magisterial District of Vryburg.

Loans and subsidy assistance (50 %) for ostriches were approved from 1 January 1981 for the irrigation areas of wards 5, 6 and 8 of Oudtshoorn and ward 9 of Calitzdorp. The loans amount to R6 per month per adult ostrich on a maximum of 300 ostriches per farmer/farming partnership/farming company. All ostriches over the age of 6 months are regarded as adults and three small ostriches of up to six months are taken as one adult bird.

Farmers who do not avail themselves of the loans qualify for subsidies on the same basis on actual purchases of approved types of feed, subject to the same restrictions.

During the period under review R15 359 449 was paid out in stock feed subsidies, as against R3 885 588 during the previous year.

Subsidy on comprehensive crop insurance for wheat and maize

During the year under review R3 696 406 was paid out in subsidies, as against an amount of R3 176 722 during the previous year.

Stock feed rebates

By December 1980, 100 districts or portions of districts were on the grazing distress list. Owing to fairly general rains in the Free State, the Eastern Cape, the Karoo and the Southern Cape, it was possible to remove 41 districts or portions of districts from the grazing distress list by 31 March 1981. During the year under review R4 297 782 was paid out under this heading, as against R2 357 929 during the previous year.

Subsidy on farm mortgage interest

R1 449 044 was allocated during the year under review for subsidies on farm mortgage interest, the phasing out of which over a period of 5 years started on 1 July 1979. R2 516 449 was spent under this heading during 1979/80.

Subsidising of interest under drought relief schemes

The special drought assistance programme in terms of which State-guaranteed Land Bank loans are made available to co-operatives so that members can be given extension of time for the repayment of production credit, including stock feed loans, was further extended during the year under review as a result of the continued drought conditions. In addition to granting extension of time for repayment, the State also subsidises the interest on carry-over debts of this kind.

At present this also applies to the 1979/80 production credit in some districts of the summer rainfall areas. The relief programme is also applicable to sugar farmers in Northern Natal.

Where the interest rate is subsidised by 3,5 % in respect of loans to co-operatives, the subsidy to individual sugar farmers is only 3 % because the Land Bank's interest rate to the latter borrowers is 0,5 % lower.

During the period under review R2 476 331 was paid to the Land Bank in the form of an interest subsidy on carry-over debts and R1 302 583 was paid during the previous period reviewed.

Subsidy on maize, bread and butter

The payment of Government subsidies on maize, bread and butter was continued and the following amounts were paid out during the past two years:

	1980/81	1979/80
	R*	
Maize	59 550 000	44 750 000
Bread	162 750 000	116 400 000
Butter	3 800 000	3 700 000

*Figures rounded off

(a) Maize

Arising from the increase in the maize price for the 1980/81 season it became necessary to raise the subsidy on maize in order to prevent a sharp rise in consumer prices.

(b) Wheat

Although the bread prices were increased on 1 April 1980 by 4c and 5c for brown and white bread respectively, increases in the wheat price and adjustments of the bakers', millers' and retailers' margins resulted in a further rise in the subsidies on bread.

(c) Butter

The relatively small provision of R2 500 000 for butter was increased by R1 500 000 in the supplementary budget to prevent an adverse effect on the consumer price. The subsidy will in future be reduced by R1 million annually.

Emergency planning and aid schemes

The Land Bank makes loan funds available for the erection of grain silos by co-operative agents of grain boards; funds for the building of grain silos by private agents, millers and processors of grain are provided for in the budget of the Department of Agriculture and Fisheries. During the year under review loan funds amounting to R35 million and R1,4 million were made available for this purpose by the Land Bank and the Department, respectively.

To allow for planning, loans for the erection of grain silos are granted approximately one year before the funds are made available for payment.

During the year under review the Grain Silo Committee recommended that, apart from the 10 % which owners contribute to the erection costs, the following amounts be granted for loans for the erection of new silos and the expansion of existing silos:

	Amount R million	Capacity m ³
Co-operative agents of grain boards	48,391	1 490 000

Loans to co-operative agents were again financed by the Land Bank, under cover of a Government guarantee. During the year under review loans to the amount of R21,5 million were paid out, which brought the total amount since the introduction of the loan scheme to R189,5 million.

During the year under review no loan funds were paid out to private agents, millers and processors of grain. Since the introduction of the loan scheme the total payments to them amounted to R8,9 million.

Land Bank loans amounting to R3,2 million were repaid during the year under review, which brings the total repayment of Land Bank loans under the scheme to R15,2 million. Of the loans granted on the budget of the Department of Agriculture and Fisheries, an amount of R338 414 was repaid during the year under review, which brings the total repayment since the introduction of the scheme to R4,7 million.

17. Agricultural financing

ASSISTANCE

Purpose and functions

One of the main objectives and functions of the Department is to make assistance available on a continuous and effective basis to eligible persons in the agricultural sector. Such assistance includes the provision of credit facilities and/or the institution of protective measures designed to benefit or promote agricultural activities, as determined by the Agricultural Credit Act, 1966.

AGRICULTURAL CREDIT BOARD

Constitution

The Agricultural Credit Board was established in terms of the Agricultural Credit Act, 1966, to endeavour to achieve the above-mentioned objectives. It consisted of the following members at the end of the period under review:

Chairman	: Mr J. le R. Retief
Deputy Chairman	: Mr J.F. Potgieter
Other members	: Messrs C.P. Fourie, A.A.B. Smit, W.F.H.A. Gevers, P.L. Steyn, R. van Rhijn, F.P. Naude, J.J. van der Merwe, F.M. Kritzinger, J.N. Bodasingh and T.A. Govender.

During the period under review the following appointments to the Board were made:

Mr J.J. van der Merwe was appointed in the place of Mr. P.J. Hugo, who died on 6 Januarie 1980. Under the Agricultural Credit Amendment Act of 1980 the membership of the Agricultural Credit Board was increased from 9 members to 12 members and Mr. F.M. Kritzinger was appointed to one of the vacant positions. Because the Agricultural Credit Board has, since the amendment of the Act, financed Indian farmers as well, two Indian members were appointed to the Board, viz Messrs J.N. Bodasingh and T.A. Govender.

Functions and activities

The primary functions of the Board, which is an autonomous body, are to assist farmers and to make recommendations regarding the recovery of debt and matters concerning security for loans, subject to the directions of the Minister.

Members of the Board visit the respective agricultural credit committees periodically in order to explain policy matters and provide guidance.

During the period under review the Board dealt with 6252 cases.

Agricultural credit committees

To assist the Agricultural Credit Board, agricultural credit committees have been appointed in most magisterial districts; the magistrates concerned serve as the chairmen. The function of these committees is to investigate and report on applications for assistance.

A liaison officer from the Department periodically visits the committees to explain the various forms of assistance and procedures so that effective functioning can be maintained. The service rendered by committee members is greatly appreciated. Attention is at present being given to the appointment of members of the Indian community to the various agricultural credit committees in cases where the interests of Indian farmers are involved.

LONG-TERM ASSISTANCE

Long-term assistance is granted in terms of the Agricultural Credit Act, 1966, for the purchase of land, for effecting improvements on land, for the redemption of debts and for the purchase of livestock, implements, etc.

Loans granted for the above purposes are limited to applicants who, for reasons beyond their control, are unable to continue farming successfully or to obtain credit facilities elsewhere. This assistance is therefore not rendered with the idea of competing with persons or institutions furnishing credit in the private sector. Loans for the erection of soil conservation works and the construction of water works are, however, available to all land-owners.

A scheme concerning the laying on of electricity was introduced on 28 February 1980. The scheme covers the connection fee that each consumer has to pay once only before the supply is connected, the deposit, which is equivalent to average power consumption calculated over a period of three months, the cost of distribution from the transformer and the electrical equipment required. This scheme was expanded on 27 August 1980 in that loans are now made available to farmers for the installation of a power line from a point where ESCOM or a municipality supplies power to the transformers on the farms. This will enable groups of farmers to take electricity right to their farms.

After the scheme for the purchase of private agricultural land had been partially reopened on 30 April 1980, the scheme had to be suspended again on 27 August 1980, except in the remote areas, owing to a shortage of funds.

Rate at which applications were received		
1980	April	116
	May	178
	June	150
	July	186
	August	145
	September	235
	October	165
	November	96
	December	73
	January	69
1981	February	86
	March	111
Total 1610 applications		

(These numbers do not include applications in respect of housing for farm labourers, means of crop production and stock feed. The number of applications in respect of these schemes dealt with during the year under review appears in Table 2.)

SPECIAL SCHEMES

Non-White housing

The above scheme is explained in detail in view of its special nature:

In view of the continuously increasing construction costs and the importance of proper accommodation for Non-White farm workers in the agricultural sector, it was decided to make a bigger contribution to the erection of and or improvements to dwellings for Non-White labourers. It was therefore decided to modify the scheme so that loans can be granted for the erection of dwellings for farm labourers on the following basis:

- (a) Not exceeding R2400 per unit for 3-roomed dwellings;
- (b) not exceeding R3200 per unit for 4-roomed dwellings;
- (c) a maximum amount of R200 in respect of a water supply and R200 in respect of electricity per dwelling unit;
- (d) for extensions to existing dwellings for farm labourers, provided that the loan for any proposed extension does not exceed 50% of the maximum loan amount for new dwellings as set out above;
- (e) a maximum of 10 dwellings per applicant per financial year, subject to the availability of funds.

The loans are subject to the registration of mortgage bonds as security and are repayable over a maximum period of 20 years. Interest is charged at a rate of 5% per annum but as four-fifths of the interest is subsidised the borrower is liable for interest at a rate of only 1%.

It is a requirement that dwellings be planned and built in accordance with the health and building control measures of the local authorities concerned.

Flood damage in parts of the Boland, Karoo and Southern Cape

While the north-western parts of the Cape Province are still suffering a severe drought, the

floods of 25 January 1981 caused by high intensity rainfall that fell in the upper reaches of the Gamka, the Buffels and the Touws Rivers especially, not only took their toll with great loss of human life and property at Laingsburg, but did damage along the river banks and in the flood plains of the Hex, Nuy, Doring, Vink, Breede, Keisie, Touws, Prins, Groot, Gamka and Gourits Rivers that is surely the most severe and widespread experienced this century.

There was great loss of life and property and a further tragic aspect of the disaster was the loss of the valuable river soil that was many farmers' greatest asset and meant so much to the country as well. Irrigated soils on which vineyards, orchards and other crops had been established were completely washed away or irreparably damaged in some cases and very severely damaged in other cases. Erosion control works, fences, irrigation installations and other water works were also severely damaged and in some cases totally destroyed.

On 27 February 1981 the Minister of Agriculture and Fisheries announced the following relief measures for the farmers who had suffered damage as a result of the floods:

- (a) (i) For the actual cost of restoring the damaged irrigated land on which vineyards and orchards had been established, up to a maximum of R1 500 per ha, and a maximum of R6 000 per ha for the re-establishment of vineyards and orchards on the restored lands;
 - (ii) for the actual cost of restoring damaged irrigated soils other than those on which vineyards and orchards were established, up to a maximum of R1500 per ha, and a maximum of R250 per ha for the re-establishment of crops other than vineyards and orchards on the restored soils;
 - (iii) for the repair and/or re-erection of stock watering points, erosion control works and inner camp fences that were destroyed or damaged and had previously been erected in accordance with the farm plan drawn up by this Department. Where such inner camp fences, erosion control works and stock watering points were not erected in accordance with a farm plan of this kind, they may be re-erected, provided this is done in accordance with the farm plan. In addition, loans and subsidies will also be payable on the repair costs for the damaged portion of flood-damaged land and boundary fences.
- Eighty per cent of the above-mentioned loans are to be converted to a Government subsidy, in other words 80% of the loan will not be repayable.
- (b) Loans that carry no Government subsidy:
 - (i) For the actual cost of restoring damaged dry lands, up to a maximum of R150 per ha;
 - (ii) for crop production, up to a maximum of R700 per ha per year over a period of three (3) years, i.e. a maximum amount of R2100 per ha in respect of lands on which vineyards and orchards were re-established.
 - (c) Loans for the purchase of approved stock feeds, carrying a subsidy of 50%, and a rebate

of 75% on railway transport costs on stock feed as at present applicable in grazing distress areas.

(d) *Ex gratia* payments

The Government also decided to compensate farmers who could prove that they had suffered damage as a result of lands being completely washed away or irreparably damaged on the following basis:

- (i) An *ex gratia* payment up to a maximum of R10000 per ha for irrigated land on which vineyards and orchards had been established;
- (ii) an *ex gratia* payment up to a maximum of R2000 per ha for irrigated land on which crops other than vineyards and orchards had been established.
- (iii) *Ex gratia* payment up to a maximum of R300 per ha for dry land.

Stock feed scheme

The emergency relief measures introduced in the grazing distress areas were further expanded and adapted with effect from 1 April 1980 in view of the fact that drought conditions had continued and increased in intensity in the North-Western Cape and the Karoo and had also spread to some areas of the Eastern Cape, the Free State and Natal. It was decided to divide the drought assistance measures into four categories, namely:

Phase 1

As soon as an area is placed on the grazing list, farmers automatically qualify for a 75% rebate on the cost of the transport approved drought feeds by the S.A. Railways.

Phase 2

Farmers can apply for loans at R2,00 per breeding small stock unit and/or R12,00 per breeding large stock unit per month, up to a maximum of 1200 ewes and/or 200 cows (maximum of R2400 per month).

Phase 3

A subsidy of 50% on loans granted comes into operation. Farmers who purchase feed out of their own funds are also entitled to a subsidy of R1,00 per breeding small stock unit and/or R6,00 per breeding large stock unit per month (maximum R1200,00 per month).

Phase 4

This phase is regarded as disaster relief and has been introduced only in the North-Western Cape and the Karoo, where there has been drought for a year or more and where disaster conditions have arisen. In these areas small stock farming is the main enterprise and the disaster relief consists of a loan of R3,00 per breeding small stock unit per month up to a maximum of 1200 ewes, which carries a subsidy of 60%. Farmers who buy feed from their own funds qualify for a subsidy of R1,80 per ewe per month up to a maximum of R2160,00. In these areas the rebate of 75% is also granted on the cost of transporting approved stock feeds by

registered private transport contractors (and not only by the S.A. Railways). Table 1 gives an indication of the proportions the drought assumed during 1980/81 and the emergency aid rendered, and of the improvements that took place after the rainy season.

With effect from 1 January 1981 a scheme was introduced in the irrigation area scheduled under the Stompdrift-Kammanassie area in the Districts of Oudtshoorn and Calitzdorp in accordance with which farmers can apply for loans for the purchase of stock feed for ostriches. The maximum loan that can be granted is R6,00 per adult ostrich per month, with a maximum of 300 head of adult ostriches per farmer. At the same time a subsidy scheme of 50% on all loans was made applicable with a 50% subsidy to farmers who buy feed from their own funds. Very few farmers availed themselves of the loan scheme but a number of applications for subsidies were received from farmers who had bought feed from their own funds.

Drought in Natal

The sugar growing area of Northern Natal was experiencing one of the most serious droughts in the history of the sugar industry at the beginning of the period under review. The District of Lower Umfolozi had been experiencing severe drought conditions since 1978/79 and the continued drought conditions experienced during the 1979/80 rainy season caused such a deterioration in the financial position of producers in the area that they required a great deal of financial assistance from the Department of Agriculture and Fisheries.

The South African Cane Growers' Association estimated that at least 5000ha of sugar-cane plantations would have to be replanted as a result of the drought because the roots of the plants had died owing to the drought. The following magisterial districts suffered severe drought during the 1979/80 rainy season:

Lower Umfolozi
Hlabisa
Mtunzini
Lower Tugela
Inanda.

As a result of urgent representations for financial aid the Department decided to make the following aid available to White and Indian farmers:

- (a) Production loans of up to a maximum amount of R40000 per calendar year per producer for the purchase of means of production such as fuel, fertiliser and seed, such loans to be repayable from the harvest.
- (b) Loans for the re-establishment of sugar-cane plantations in cases where they had to be replaced owing to the drought. These loans will be repayable over a period of seven years, interest for the first two years of which will be capitalised; the loan plus the capitalised interest will be repayable in equal annual payments over a period of five years from the end of the third year.
- (c) Consolidation of existing debts of producers.

TABLE 1 - Number of districts on the grazing distress list (December 1980)

Kind of assistance rendered	Position before the 1980/81 rainy season				Position as at 31 March 1981			
	C.P.	O.F.S.	Natal	Total	C.P.	O.F.S.	Natal	Total
Phase 1	18	12	2	32	10	1	0	11
Phase 2	16	8	0	24	9	2	0	11
Phase 3	27	0	0	27	21	0	0	21
Phase 4	17	0	0	17	16	0	0	16
Total	78	20	2	100	56	3	0	59

Water scarcity in parts of Gordonia

As a result of representations received from organised agriculture, a scheme was introduced with effect from 1 February 1981 to 31 March 1981 in Divisional council wards 4, 5, 6, 10 and 11, Gordonia, to make loans available to farmers for the provision of water for their livestock. The loans that could be granted were restricted to R2,00 per small stock unit and/or R12,00 per large stock unit per farmer per month, up to a maximum of R6000,00 per farmer per months (or the carrying capacity of the land - whichever was the least).

This scheme did not carry a subsidy, which was apparently the reason why only one application was received.

Miscellaneous

In addition to the forms of assistance mentioned previously, there are the following special aid measures:

- A scheme in terms of which farmers can apply to establish plantations on parts of their farms less suited to field crops. The Agricultural Credit Board can also make loans up to a maximum of R2500 available to timber growers to build two fire control dams.
- A scheme for the control of encroaching bush (swarthaak - *Acacia detineus*) in parts of the North-Western Cape, namely the Magisterial Districts of Mafikeng, Vryburg, Postmasburg and Kuruman. The scheme also makes provision for the control of encroaching bush by aerial spraying. The cost attached to this method amounts to about R22 per ha. Applicants can apply for loans to cover half the cost, up to a maximum of R11 per ha.

SHORT-TERM ASSISTANCE

Crop production loans are of a continuous nature and may be granted in all the recognised field cropping areas of the country. The purpose of these loans is to render financial assistance to farmers who, as a result of farming setbacks or other factors beyond their control, lack sufficient funds or cannot obtain the necessary credit for their purposes elsewhere. Loans not exceeding R40000 per calendar year are available for this purpose. A maximum of R8000 of this amount may be used for the cultivation of forage crops for the farmer's own use.

These loans are granted for the purchase of the following means of production for crops:

Seed
Fertiliser
Fuel (excluding petrol)
Lubricants and grease
Sprays for the control of pests
Parts for tractors and farm implements (including the costs of repairs)
(Electricity accounts for the pumping of water for irrigation purposes may also be paid from these loans.)

These loans are normally repayable from the proceeds of the applicant's next crop. Ownership of the crops cultivated by the applicant vests in the State as security until the debt has been repaid in full or until discharge of the security has been granted.

DISPOSAL OF APPLICATIONS

Particulars of how the applications received by the Board were disposed of are contained in Table 2.

TABLE 2 - Disposal of applications

Purpose	Granted		Refused
	Number of loans	Amount R	
Stock feeds	459	28221114	26
Purchases of land	385	29849048	444
Consolidation of debt	410	13076186	411
Irrigation works	136	3704851	53
Coloured housing	186	1831138	9
Soil conservation works	102	1297192	3
Means of crop production	675	11096254	255
Housing for farm labourers	139	2217398	1
Livestock	95	1167822	204
Implements	38	546169	66
Drilling	11	74385	2
Improvements	34	443752	37
Afforestation	2	29325	0
Encroaching bush	2	21780	2
Electricity	1	18321	0
1980/81	2675	93594735*	1513
Total 1979/80	3249	47163792	1168

*Amount actually spent : R56484500

On 31 March 1981 some applications received during the year under review were still being dealt with, and some of the applications dealt with were carried over from the previous year.

RENDERING OF ASSISTANCE IN REMOTE AREAS

The special assistance scheme in terms of which assistance to farmers was introduced in the so-called remote areas with effect from 1 January 1980 includes loans for the purchase of agricultural land by farmers wishing to concentrate on full-time farming in these areas.

In the case of farmers already established in these areas, applications for assistance, especially for the payment of pressing debts, received sympathetic consideration. The means test is still in force but it is applied as liberally and reasonably as possible. The repayment periods are also made as reasonable as possible. Loans for the purchase of land are granted within the limits of realistic economic values. Applications have been awaited from 2 January 1980 and are dealt with in the usual way.

The areas where the scheme applies stretch from the border between the Transvaal and Zimbabwe and Botswana in the Northern and Western Transvaal and along the border between the Transvaal and Mozambique in the Eastern Transvaal South of the Kruger National Park and north of KaNgwane).

Rate at which applications were received

1980	April	86
	May	45
	June	61
	July	68
	August	20
	September	80
	October	52
	November	64
	December	29
1981	January	31
	February	35
	March	26
		597

TABLE 3 - Disposal of applications

Purpose	Granted		Refused
	Number of loans	Amount	
		R	
Purchases of land	212	20390759	165
Consolidation of debts	72	2250662	39
Irrigation works	24	1207077	11
Means of crop production	29	333141	12
Livestock	47	677100	50
Implements	9	152656	13
Improvements	1	4885	4
Total	394	25016280*	294

*Amount actually spent - R16940000. Some of the applications received were still being dealt with.

Of the total number of applications for the purchase of land approved, 66 applications came from outside the area, 61 came from lessors who had acquired their own land in the areas concerned through assistance, 16 came from share croppers,

49 from applicants who possessed uneconomic units and were assisted to purchase additional land, and 10 father/son transactions were approved, i.e. in the latter manner 10 young farmers were assisted to become established in the area. The Board also assisted six companies and four other persons to acquire land. (See Table 3.)

RECOVERY OF LOANS AND RELATED MATTERS

As is apparent from the data given under "Statistics", the following activities placed a considerable burden on the depleted staff:

Obtaining of security for loans

The drawing up and registration of mortgages as security for loans granted under the Agricultural Credit Act, 1966, required a great deal of attention during the past year owing to the rendering of considerable assistance to farmers in the remote border areas. The issue of deeds of grant to persons to whom State land had been allocated in terms of the Act and to persons who had obtained long-term deeds of lease under the Settlement Act of 1956 had to be dealt with at the same time.

Furthermore, because funds for certain forms of assistance were limited there was an increase in applications by the Land and Agricultural Bank of South Africa to waive the priority sequence of the State mortgage bonds in favour of the Bank's proposed mortgage bonds. In such cases the State mortgage is generally extended over the land purchased.

Consents and estates

Applications for separate alienation of properties linked in terms of section 35(1)(b) of the Act to the registration of mortgage bonds over immovable property that may not, in terms of section 35(1)(c), be further mortgaged without the consent of the Minister increased, and a number of deceased and insolvent estates were reported. Applications to take over existing debts in terms of section 11 of the Act were also considered.

Control over securities

A watchful eye was kept on securities consisting of mortgaged immovable property, movable property such as livestock and farm implements and crops grown with State assistance, the ownership of which vests in the State. The assistance rendered by agricultural co-operatives in the latter regard and the co-operative spirit in which arrangements were made to assist farmers experiencing financial problems were praiseworthy. Increasing use was made of the services of Departmental outdoor officers, notwithstanding staff shortages, to keep an eye over the crops being cultivated with State assistance and, as far as

possible, also over the recovery of debts. A very successful conference of outdoor officers was held on this subject towards the end of the year.

Recovery of debts

An outstanding achievement was recorded during the past year in that a record amount of over R37 million was recovered, notwithstanding a rapid staff turnover and a shortage of staff in certain key positions. Numerous matters were submitted to the Agricultural Credit Board for recommendations to the Minister of Agriculture and Fisheries and many hours of overtime were worked by all sections in order to cope with the work.

Statistics

The following data is supplied for interest's sake:

Documents drawn up and registered:

Deeds of grant	192
Mortgage bonds	936
Consents	4153
Total	5281

Board cases drawn up:

Taking over of debt	69	
Taking over of estate debts	50	(473 estates on hand)
Separate alienations	182	
Waiving of mortgage bond sequence	377	
Consent to further mortgages	255	
Total	933	

Outstanding debts

Amounts due to the Department under the Agricultural Credit Act, 1966, and other Acts under which loans were granted in the past now amount to R198143655,34. The amount of R37167478,66 was recovered during the year under review.

(3) FINANCES		
(a) Expenditure 1980/81		
	Amounts allocated	Expenditure
	R	R
Administration	14956000	16618804,85
Plant production promotion	13258000	14046949,77
Animal production promotion	29622000	30962965,02
Agricultural resource utilisation	13784000	14046592,78
Entrepreneur development	7941000	8578276,60
Sea fisheries	18662000	17855849,71
Supporting/associated services	14611000	16846502,11
Agricultural production economics	618000	502864,47
Agricultural marketing	18023000	16806359,91
Subsidies and assistance	280712000	263864816,09
Agricultural financing	60793000	57954648,13
Thefts and losses		11840,18
	472980000	458096469,62
Less: Internal levies	3943000	4628466,02
	469037000	453468003,60
Less: Cash discount		6481,94
Plus: Salary adjustments from Vote 31	None	
Total	469037000	453461521,66
(b) Income 1980/81		
	R	
Vaccine sales	2870909,65	
Product sales	4401652,62	
Rental	196198,84	
Interest	6341495,43	
Miscellaneous	27894054,66	
Agricultural financing	23261310,78	
Total	64965621,98	

18. Administrative matters

THE ESTABLISHMENT

The following is an indication of the posts in the Department (in the respective divisions into which posts are classified in the Public Service) as at 31 March 1981, as well as of the number of vacancies in each division, compared with the position at 31 March 1980.

Division	1980-03-31			1981-03-31		
	Authorised posts	Vacant posts Number	%	Authorised posts	Vacant posts Number	%
Administrative	205	30	14,6	322	46	14,3
Clerical	557	105	18,8	810	90	11,2
Professional	1 446	247	17,1	1 683	280	16,6
Technical	1 723	408	23,7	2 180	471	21,6
General A	79	15	18,9	85	21	24,7
General B	2 137	386	18,1	2 501	565	22,6
Non-classified	143	35	24,5	300	90	30,0
Posts additional to the authorised establishment	187	69	36,8	221	68	30,8
Total	6 477	1 295	19,9	8 102	1 631	20,1

Increase/decrease in the number of authorised posts in the various divisions over the past five years:

Division	1977-06-30	1978-06-30	1979-06-30	1980-03-31	1981-03-31	Total % increase or decrease (base year = 1977)
Administrative	172	190	193	205	322	87,2
Clerical	511	514	538	557	810	58,5
Professional	1 459	1 470	1 504	1 446	1 683	15,7
Technical	1 660	1 683	1 779	1 723	2 180	31,3
General A	81	81	78	79	85	4,9
General B	2 217	2 235	2 304	2 137	2 501	12,8
Non-classified	187	190	157	143	300	60,4
Total	6 287	6 363	6 553	6 290	7 881	+ 25,3

IMPORTANT ORGANISATIONAL AND ESTABLISHMENT CHANGES

1. The meat hygiene service of the Department was unable to function efficiently because the organisation had not kept pace with changed circumstances and needs. The Department reorganised this service, with effect from 1 November 1980 and in consultation with the Commission for Administration, to adapt to changed circumstances.
2. Potato and cotton research, which used to be the responsibility of the Transvaal Region of the Department, was centralised with effect from 1 January 1981 under the Horticultural Research Institute and the Tobacco Research Institute, respectively.
3. The establishment of the Division of Agricultural Information was reorganised with

effect from 1 May 1980 to adapt to changed circumstances and needs.

4. The administrative establishments of the Soil and Irrigation Research Institute and the Animal and Dairy Science Research Institute were strengthened with effect from 1 January 1981 and 1 October 1980, respectively, to adapt to changed requirements.

5. An improved salary and post structure for the agricultural scientists of the Department was introduced with effect from 1 April 1980, and was accompanied by a reorganisation of the establishments of Departmental institutions. The principle of multidisciplinary work teams was introduced during this reorganisation, with the result that the research sections on the establishment of Departmental institutions were consolidated.
6. During the above-mentioned reorganisation a Subdivision of Agricultural Training was formally introduced at the five agricultural Regions that have a college of agriculture and a suitable post structure was created at the same time.
7. The Institute of Sea Fisheries of the former Department of Industries became the responsibility of this Department from 1 April 1980. Following the rationalisation of the Departments of Agriculture on 1 April 1980, the Departments of Agriculture Technical

Staff gains and losses

Division	1979-07-01 to 1980-03-31			1980-04-01 to 1981-03-31		
	Gains*	Losses**	%	Gains*	Losses**	%
Administrative	21	13	+ 38,1	8	33	- 312,5
Clerical	151	123	+ 18,5	260	264	+ 1,5
Professional	135	126	+ 6,7	204	189	+ 7,4
Technical	213	179	+ 15,9	233	341	- 46,4
General A	11	14	- 27,3	17	26	- 52,9
General B	538	532	+ 1,1	770	915	- 18,8
Non-classified	48	56	- 16,7	122	112	+ 8,1
Total	1 117	1 043	+ 6,6	1 614	1 880	- 16,5

*By "gains" is meant all officers gained by every Division, i.e. appointments from outside, promotions and translations from one Division to another and transfers from other Departments

**By "losses" is meant all officers lost by various divisions (individually or jointly), including translations and promotions to other divisions and cases where persons left the service for good, such as resignations, deaths, retirements, abscondences and dismissals

Services, Agricultural Economics and Marketing and Agricultural Credit and Land Tenure disappeared and a new Department of Agriculture and Fisheries was created. The Financial Assistance Branch of the former Department of Agricultural Credit and Land Tenure became the responsibility of the Department of Agriculture and Fisheries with effect from 1 June 1980.

TRAINING AND STAFF DEVELOPMENT

BURSARY SCHEME

The Department administers a bursary scheme for under-graduate study at local universities from funds donated by the various control boards. The following table shows the number of bursaries awarded since 1978, and their monetary value:

Grants	Number of bursaries		Number of students who qualified	Total monetary value of new grants
	New grants	Total		
Grants up to 1978	33	216	31	R 86 500
Grants to 1979	37	222	35	R102 500
Grants to 1980	34	221	39	R123 500
Grants to 1981	21	206	36	R 99 000

STAFF CHANGES (SENIOR STAFF)

RETIREMENTS

The following senior officers left the service on pension upon reaching the age limit, after a long career:

Name	Rank	Institution to which attached	Date of retirement
Dr D.E. Osbourne	Asst Dir.	Dir. of Veterinary Services	1981-01-31
Mr C.S. van der Poel	Under-Secretary	Directorate: AEM	1980-07-31
Mr S.A.D. van Schalkwyk	Dep. Dir. Gen.	Directorate AEM	1980-12-31
Dr K.E. Weiss	Director	Veterinary RI	1980-06-30

IN-SERVICE TRAINING

In order to promote efficiency and foster skills and motivation, staff serving on the establishment of the Department underwent the

RESIGNATIONS

The following senior officers resigned:

Name	Rank	Institution to which attached	Date of termination of service
Dr G.G. Newman	Dep. Dir.	Inst. of Sea Fisheries	1981-01-16
Dr H.H.P.A. Schneider	Dep. Dir.	Div. of Veterinary Services	1980-10-31

DEATHS

Name	Rank	Institution to which attached	Date of death
Dr D.P. Annecke	Dep. Dir.	Plant Protection RI	1981-03-25

following training:

Course	Number of officers involved
<i>Administrative courses</i>	
Induction	215
Management course for managerial officers	15
Merit assessment	320
Course in communication and public appearance	42
<i>Functional courses</i>	
Irrigation	68
Stock inspection	78
Soil classification	43
Legal matters	12
Meat inspection	14
Tru projector and transparencies	52

FORMAL TRAINING

Officers of the Department are afforded ample opportunity to improve their academic qualifications at Government expense, for purposes

of appointment, promotion and also self-development, as is evident from the following data:

<i>Diploma training:</i> Technicians and meat inspectors	
Undergoing training	195
Training completed	33
<i>Formal in-service training:</i> Meat examiners	
Undergoing training	22
Training-completed	27
<i>Post-graduate study:</i> (Local universities)	
Released for study (1981):	
B.Sc. (Hons.)	8
B.Agric. (Hons.) (Inst/ Agrar)	28
B.Sc. (Agric.) (Hons.)	6
Studies completed (1980):	
B. Agric. (Hons.) (Inst/ Agrar)	2
B.Sc. (Agric.) (Hons.)	17
B.Sc. (Hons.)	2
<i>Diploma training (Optional)</i>	
Public administration, State Accounts and Finance and Cost Accounting	11

PROMOTIONS (SENIOR STAFF)

Name	Rank	Institution	Date of promotion
Mr W.J. Treurnicht	Dep. Director-General	Directorate of Agricultural Economics and Marketing	1 January 1981
Dr R.D. Bigalke	Director	Veterinary Research Institute	1 July 1980
Mr D.H.J. Coetzee	Director	Inspection Division	1 January 1981
Mr Q. Momberg	Dep. Director	Division of Agricultural Information	1 August 1980
Mr D.J. Jordaan	Dep. Director	Investigations Division	1 December 1980
Mr C.J. Bester	Dep. Director	Division of Agricultural Marketing Research	1 January 1981
Dr C. Howell	Dep. Director	Veterinary Research Institute	1 October 1980

19. Organisation and functions of the Department

Dr D.W. Immelman: *Director-general*

A. Directorate Agricultural Technical Services

Dr D.J. Agenbach: *Deputy Director-general*

Directorate (Agricultural Building, Beatrix Street/Private Bag X116, Pretoria 0001)

Dr J.C. Strydom: Chief Director (Chairman of the Directorate)

Mr E. Strydom: Chief Director (Horticulture)

Prof. S.A. Hulme: Chief Director (Crops and Pastures)

Dr J.E. Erasmus: Chief Director (Farming and Natural Resources Development)

Dr W.J. Hugo: Chief Director (Animal Production)

Subdirectorates (Agricultural Building, Beatrix Street/Private Bag X116, Pretoria 0001)

Dr A.J. Pienaar: Director (Crops)

Dr A.D. Nieuwoudt: Director (Irrigation Co-ordination)

Dr J.J. du Toit: Deputy Director (Horticulture)

Mr R.W. Nott: Deputy Director (Co-ordination of Agricultural Resource Development)

Mr A.B. Bridgens: Deputy Director (Secretary-General SARCCUS)

Mr P.F. du Toit: Deputy Director (Pastures)

Dr N.J. Robbertse: Deputy Director (Extension and Training)

Mr D.J. Jordaan: Deputy Director (Fisheries)

Foreign Representatives

Paris (South African Embassy, 59 Quai D'Orsay, 75007 Paris, France)

Dr J.G. Boyazoglu: First Counsellor (Agricultural Technical)

Mr J.U. Rietmann: Counsellor (Agricultural Technical)

Dr J. le Roux: Attaché (Agricultural Technical)

Mr B.K. van der Merwe: Counsellor (Agricultural Economics)

Mr F.M.S. Jordan-Rozwadowski: Assistant Attaché (Agricultural Technical)

London (South African Embassy, Trafalgar Square, London WC2N 5DP, England)

Dr A. Myburgh: Counsellor (Agricultural Technical)

Mr J.P. Carstens: Counsellor (Agricultural Economics)

Mr J.G. van Wyk: Consul (Agricultural Production Inspectorate)

Washington (South African Embassy, 4801 Massachusetts Ave. N.W., Suite 350, Washington D.C. 20016, U.S.A.)

Dr J.E. Nel: Counsellor (Agricultural Technical)

Mr M.D. Strauss: Counsellor (Agricultural Economics)

Mr C.J. Wilken: Attaché (Agricultural Scientific)

Argentina (Embassy of the Republic of South Africa, M.T. De Alvear 590, 1058 Buenos Aires)

Mr J.J. Farrell: Counsellor (Agricultural Technical)
Australia (South African Embassy, Rhodes Place, Yarralumla ACT 2600, Canberra, Australia)

Mr J.H. l'Ons: Counsellor (Agricultural Technical)
Belgium (South African Embassy, Rue de la Loui (bte 15-16 1040 Brussels, Belgium)

Mr H. Steynberg: Counsellor (Agricultural Economics)

Mr R.M. Gravelé-Blondin: Attaché (Agricultural Economics)

Germany (South African Embassy, Auf der Horstert 3, 53 Bonn-Bad Godesberg, Federal Republic of Germany)

Dr J.J. Gregory: Counsellor (Agricultural Economics)

Specialised Research Institutes

Soil and Irrigation Research Institute

Belvedere Street, Private Bag X79, Pretoria 0001

Dr M.C. du Plessis: Director

Dr C.N. MacVicar: Deputy Director (Pedology and Irrigation Planning)

Dr C.E.G. Schutte: Deputy Director (Analyses)

The Institute is responsible for the classification of the resources, soil and climate of the Republic and also basic research with regard to the physical and chemical properties of soils on a national level. Soil surveys for irrigation projects and investigations into physical soil properties are also undertaken - particularly where brack and waterlogging conditions occur. In addition, the Institute undertakes chemical soil, water and plant material analyses, not only for this Department, but also for other State Departments, provincial administrations and other bodies. This Institute is also responsible for the inspection and analysis of fertilisers, stockfeeds, stock remedies and agricultural remedies in terms of Act No. 36 of 1947. It is also responsible for basic irrigation research and the agricultural evaluation and planning of irrigation areas. All agricultural meteorological research and data collection also falls under this Institute.

Plant Protection Research Institute

Agricultural Building, Beatrix Street, Private Bag X134, Pretoria 0001

Dr I.H. Wiese: Director

Dr D.P. Keetch: Deputy Director
Dr H.A. van de Venter: Deputy Director

The Institute is broadly responsible for advanced research at the national level on plant pathology, insect and animal pests and their control. This includes microbiology, taxonomy of fungi, identification of virus diseases, the freeing of propagation material from viruses, honey-bees, insects in stored grain, forest and timber insects, taxonomy of insects and nematodes, economic zoology, toxicology of insecticides and the biological control of insect pests and weeds. The Institute is also responsible for the examination and control of imported plant material and the control of migratory locusts.

Botanical Research Institute
Private Bag X101, Pretoria 0001

Dr B. de Winter: Director
Dr D.J.B. Killick: Deputy Director

The Institute undertakes basic research on the flora and vegetation of South Africa with emphasis on taxonomy, morphology, ecology and economic botany. The Institute also controls the Botanic Garden at Brummeria (Pretoria) and herbaria in Durban, Grahamstown, Kimberley, Pretoria, Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute
Private Bag X11208, Nelspruit 1200

Dr J.H. Grobler: Director
Mr A. van Oostrum: Deputy Director

The Institute is responsible for country-wide research on all aspects of the citrus and subtropical fruit industry, as well as nuts, tea, coffee and herbs.

Sea Fisheries Institute
Private Bag X2, Roggebaai, 8012

Mr C.H. Stander: Director
Mr A.P. le Roux: Deputy Director
The purpose of the Institute is to promote the rational utilisation of marine sources.

Tobacco Research Institute
Kroondal, Private Bag, Rustenburg 0300

Dr D.J. Rossouw: Director
Dr W.J. Pienaar: Deputy Director
The Institute is responsible for research, including technological research, in the interest of the tobacco industry in all parts of the country.

Horticultural Research Institute
Private Bag X293, Pretoria 0001

Dr A.J. Heyns: Director
Dr J.T. Meynhardt: Deputy Director
The Institute is responsible for all applied and fundamental research and specialised extension on vegetables, cut-flowers, ornamental plants and shrubs throughout South Africa and on deciduous fruit and table grapes in the summer rainfall areas. The

Institute controls research stations for vegetables, flower, ornamental plants, table grapes and deciduous fruit research at Rooodeplaas in the Transvaal Middleveld and for cherry and deciduous fruit at Emperani, near Ficksburg.

Veterinary Research Institute
P.O. Onderstepoort, Pretoria 0110

Dr R.D. Bigalke: Director
Dr C.J. Howell: Deputy Director
Dr T.W. Naudé: Deputy Director
Dr D.W. Verwoerd: Deputy Director (Virus Diseases) (personal)

The Institute is concerned with research on diseases of stock and game (infectious and others, including diseases caused by malnutrition), diagnostics, the preparation of vaccines and diagnostic aids, and the biological evaluation of dips and remedies submitted for registration.

Animal and Dairy Science Research Institute
Private Bag X2, Irene 1675

Dr J.H. Hofmeyr: Director
Dr J.C. Oosthuizen: Director
Dr P.E. Lombard: Deputy Director

The Institute, at various centres throughout the country, undertakes performance and progeny testing at the national level, as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen.

Fruit and Fruit Technology Research Institute
Private Bag X5013, Stellenbosch 7600

Dr P.G. Marais: Director
Dr J.H. Terblanche: Deputy Director
The Institute is responsible for research on deciduous fruit, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products. The Institute further renders a radiation and radio-isotope service in connection with agricultural problems in the winter rainfall complex.

Oenological and Viticultural Research Institute
Private Bag, Stellenbosch 7600

Dr J. de V. Burger: Director
Dr J. Deist: Deputy Director
The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area.

Divisions

Division of Soil Protection

Agricultural Building, Beatrix Street,
Private Bag X120, Pretoria 0001

Mr C.R. Baard: Director

Mr J.L. Vosloo: Deputy Director

The Division is responsible for the administration of the Soil Conservation Act (Act No. 76 of 1969), the Weeds Act (Act No. 42 of 1937) and the Subdivision of Agricultural Land Act (Act No. 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme, Flood Assistance Scheme and Grass Ley Scheme.

Division of Agricultural Engineering

Private Bag X515, Silverton 0127

Mr J.J. Bruwer: Director

Mr C.T. Crosby: Chief Engineer

Dr B. van D. Boshoff: Chief Engineer

The Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of vegetables, fruit and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes.

Division of Agricultural Information

Agricultural Building, Beatrix Street,
Private Bag X144, Pretoria 0001

Mr R.J. van Niekerk: Director

Mr Q. Momberg: Deputy Director

The function of the Division is the distribution of agricultural information by means of the mass media. For this purpose use is made of scientific and popular agricultural publications, radio programs, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Division of Plant and Seed Control

Agricultural Building, Beatrix Street, Pretoria 0001

Mr J.F. van Wyk: Director

Mr D.C. Lourens: Deputy Director

The functions of the Division include the protection of propagation material and the assurance of its quality. The Division administers the Seeds Act (Act No. 28 of 1961), the Plant Breeders' Rights Act (Act No. 22 of 1964) and the Agricultural Pests Act (Act No. 3 of 1973).

Division of Veterinary Services

Transvaal Agricultural Union Building,
281 Struben Street, Private Bag X138,
Pretoria 0001

Dr J.P. van der Merwe: Director

Dr J.D. Coetzee: Deputy Director (Meat Hygiene)

Dr J.M. Erasmus: Deputy Director (Regulatory Services)

The Division has a specific task in regard to animal health as laid down in the Animal Diseases and Parasites Act, 1956 (Act No. 13 of 1956) and regulations promulgated in terms thereof. The Division guards against the introduction of diseases by erecting, patrolling and maintaining game and cattle-proof fences on the borders of the Republic of South West Africa and by controlling animal imports. For domestic protection, regular inspections of all stock are carried out. The promotion of animal health schemes to eradicate certain diseases and animal health in general enjoy high priority.

Agro-ecological Regions

The seven Regional Organisations of the Department are responsible, within their respective geographical areas, for the planning, development, promotion and application of farming systems based on optimum land use.

Each region provides an extension service in which the soil conservation effort is integrated and which also covers every aspect of farming. The research services are directed to the collation and releasing of scientific knowledge for the optimum use of the natural agricultural resources. The research personnel is also responsible for specialist extension work and for supplying training services to the agricultural colleges.

Highveld Region

Private Bag X804, Potchefstroom 2521

Dr J.D. Slabber: Director

Dr J.E. van Niekerk: Deputy Director

Dr W.P. Grobbelaar: Director (Summer Grain Research Centre, Potchefstroom)

Potchefstroom College of Agriculture

Research Stations/Experiment Farms -
Potchefstroom complex (Central research station), Bethlehem and Swartrand (Ventersdorp) (gousiekte research)

Karoo Region

Grootfontein, College of Agriculture, Private Bag X529, Middelburg, Cape 5900

Dr P.W. Roux: Director

Mr D.J. van Z. Smit: Deputy Director

Grootfontein College of Agriculture

Research Stations/Experiment Farms -
Grootfontein, Middelburg, C.P. (Central research station), Carnarvon, Tarka

Conservation Area, Hales Flats and Jansenville

Natal Region

Private Bag X9059, Pietermaritzburg 3200

Dr P. Hildyard: Director

Mr R.H. Peard: Deputy Director

Cedara College of Agriculture

Research Stations/Experiment Farms - Cedara (Central research station), Drakensberg complex (Estcourt), Northern Natal (Dundee), Kokstad and Pongolapoort (Makatini)

Eastern Cape Region

Private Bag X15, Stutterheim 4930

Mr H.S. Niehaus: Director

Dr A.D. Venter: Deputy Director

Research Station - Dohne (Stutterheim) (Central research station) and Bathurst (Port Alfred)

A number of experiments are also carried out at East London

Transvaal Region

Agrivaal Building, c/o Edmund and Hamilton Streets, Private Bag X180, Pretoria 0001

Mr D.F. de Wet: Director

Mr S.J. Gericke: Deputy Director

Research Station/Experiment Farms - Roodeplaat (Central research station), Soutpan (Pretoria), Athole (Amsterdam), Loskop (Groblersdal), Mara (Louis Trichardt), Messina, Nootgedacht (Ermelo) and Towoomba (Warmbaths)

Free State Region

Glen College of Agriculture, Glen 9360

Mr T.E. Skinner: Director

Mr G.W. Oosthuysen: Deputy Director

Research Stations/Experiment Farms - Glen (Central research station), Armoedsvlakte (Vryburg), Koopmansfontein (Barkly West), Rietrivier (Herbert), Sandvet, Upington complex and Vaalharts (Jan Kempdorp)

Winter Rainfall Region

Private Bag, Elsenburg 7607

Dr J. Serfontein: Director

Dr P.J.S. Pieterse: Deputy Director

Mr A. Viljoen: Deputy Director

Elsenburg College of Agriculture

Research Station/Experiment Farms - Elsenburg, Mariendal (Stellenbosch), Langgewens (Moorreesburg), Nortier (Lambert's Bay), Oudtshoorn, Outeniqua (George), Tygerhoek (Riversonderend) and the Worcester Veld Reserve

B. Directorate Agricultural Economics and Marketing

Dirk Uys Building, Hamilton Street, Private Bag X250, Pretoria 0001

Mr W.J. Treurnicht: Deputy Director-General

Mr I.S. Geldenhuys: Chief Director (Economics)

Division of Agricultural Economics

Dirk Uys Building, Hamilton Street, Private Bag X250, Pretoria 0001

Mr H.S. Hattingh: Director

Mr J.S.G. Joubert: Deputy Director

The Division's main task is to research the production economics of agriculture and to make known the research results and general production economics principles.

Division of Inspection Services

Dirk Uys Building, Hamilton Street, Private Bag X250, Pretoria 0001

Mr P.J. Wessels: Director

Mr J.P. van der Walt: Deputy Director

The task of the Division is to regulate the quality and packing of specific agricultural products. The Division not only provides an inspection service, but also sets the standards for agricultural products. The inspection function is only carried out to ensure that the standards are met.

Division of Co-operatives

CSMAA Building, Beatrix Street, Private Bag X237, Pretoria 0001

Mr H.J.L. du Toit: Director

Mr N.F. Pienaar: Deputy Director

The task of the Division is to promote an orderly and sound co-operative industry. It includes, inter alia, control of the registration and functioning of co-operatives.

Division of Agricultural Marketing Research

Dirk Uys Building, Hamilton Street, Private Bag X250, Pretoria 0001

Mr J.K. Siertsema: Director

Mr C.J. Bester: Deputy Director

Mr N. Saulez: Deputy Director

The function of the Division is to make available information concerning the marketing of agricultural products.

Investigations Division

Dirk Uys Building, Hamilton Street, Private Bag X250, Pretoria 0001

Mr D.H.J. Coetzee: Director

Mr I.Z. de K. Nel: Deputy Director

The task of the Division is to investigate matters in terms of the Marketing Act.

C. Directorate Legal and General Administration

Agricultural Building, Beatrix Street, Private Bag X116, Pretoria 0001

Mr B.W. Viljoen: Deputy Director-General

Administration Branch

Vacant: Chief Director

Financial Assistance Branch

Mr P.N. Badenhorst: Director
Mr D. Barkhuizen: Deputy Director

Division of Personnel Administration

Mr J.C. Visser: Director
Mr P.M.A. Spreeth: Deputy Director

Finance Division

Mr P.F. Nortje: Director
Mr J.J. Lombard: Deputy Director

Division of Management Services

Mr L.J. Botha: Director
Mr G.J. Peens: Deputy Director

Division of Technical and Legal Affairs

Mr B.J. Dreyer: Director
Mr H.F. van Zyl: Deputy Director

Division of Marketing Administration

Mr S.C.H. Alberts: Director
Mr G.J. Coetzee: Deputy Director

20. Relations with other countries

DIRECTORATE AGRICULTURAL ECONOMICS AND MARKETING

In view of the important part played by agricultural exports in the country's economy and the dependence of important branches of the agricultural industry on export earnings, it is essential for the Directorate of Agricultural Economics and Marketing of the Department to cultivate and maintain close contact with overseas countries at various levels. These contacts are made possible by direct representation in a number of the most important overseas countries, by membership of various international organisations and by the attendance of international conferences, deliberations and meetings on agricultural matters.

(a) OFFICERS STATIONED ABROAD

During the period under review the following officers of the Directorate of Agricultural Economics and Marketing were stationed abroad:

- (i) **South African Embassy, London**
 - A Counsellor (Agricultural Economics)
 - A Consul (Agricultural Produce Inspectorate)
- (ii) **South African Embassy, Washington**
 - A Counsellor (Agricultural Economics)
- (iii) **South African Mission to the EEC and South African Embassy, Brussels**
 - A Counsellor (Agricultural Economics)
 - An Attaché (Agricultural Economics)
- (iv) **South African Embassy, Paris**
 - A Counsellor (Agricultural Economics)
- (v) **South African Embassy, Bonn**
 - A Counsellor (Agricultural Economics)
- (vi) **Mozambique**

Inspectors for the inspection of maize and citrus exported from the RSA via the harbour of Maputo.

Western Europe and the United Kingdom are by far the most important export markets for South African agricultural products, and the Department's agricultural economics officers in London, Bonn, Paris and Brussels are therefore closely concerned with the Republic's export of agricultural commodities to these markets.

In addition to reporting on developments in the field of agricultural economics, import measures and regulations and trends in the enlarged European Economic Community, the officers concerned also participated in a wide range of international meetings concerning agricultural matters of interest to the Republic. The most important of these meetings were:

- (i) The General Agreement on Tariffs and Trade (GATT)

The tariff cuts agreed on during the recent Tokyo round of the Trade Negotiations are now being implemented by the member countries. Amongst others, the following multilateral agreements or codes about which negotiations were conducted during the Tokyo round took effect:

Agreement on Subsidies and Countervailing Duties

Agreement on Technical Trade Barriers

Agreement on Import Licensing

Agreement on Customs Values

Agreement on Revised Anti-dumping

Measures

International Agreement on Beef

International Dairy Agreement, including three protocols

concerning milk powder, butter and certain types of cheese respectively.

All the agreements have a bearing on agriculture; the Department is intensively involved in the last two.

- (ii) The International Wheat Council and its Executive Committee
- (iii) The International Wool Study Group
- (iv) The International Coffee Agreement

As regards the United States of America, the Agricultural Economics component's officer in Washington acts mainly as a link to keep the Department informed of developments in the field of agricultural economics in that country. During the period under review, information was also received about a variety of subjects, which enabled the Department to keep abreast of policy changes, production and market and price trends, as well as of research techniques and results in the field of agricultural economics in the USA.

South Africans from the agricultural sector again paid numerous visits to Western Europe and the USA, and officers from the Department arranged a large number of programmes and appointments for these visitors. In addition the officers also dealt with numerous enquiries from interested persons and organisations in the various countries and in South Africa.

As a result of the wide range of activities of the officers stationed abroad and their personal contacts with the foreign authorities concerned, the Department's international contacts were further extended during the year under review.

(b) INTERNATIONAL ORGANISATIONS

The Department is closely concerned with the activities of a number of international organisations, namely:

(i) The International Wheat Council

The International Wheat Agreement came into effect in 1949. The agreement is administered by the International Wheat Council and has already been revised several times. The Wheat Trade Convention and the Food Aid Convention, which together constitute the International Wheat Agreement, 1971, have been extended repeatedly. During March 1979 both Conventions were again extended by means of protocols, to 30 June 1981, with the proviso that should a new agreement come into force prior to that date, the protocols would remain in force only until the new agreement came into effect. During a special session of the International Wheat Council in March 1981 it was decided that the Conventions should be extended to 30 June 1983 with a similar proviso. In the mean time attempts to find a generally acceptable basis for a new agreement are continuing, and a re-negotiation conference will probably be held before the new protocols come to an end. South Africa is not a signatory to the Food Aid Convention.

(ii) The International Wool Study Group

South Africa has been a member of this Group since its inception in 1946. The main object of the Group is the collection and publication of statistics on the production and marketing of wool, wool products and other fibres.

(iii) International Association of Wholesale Markets

The biennial meetings of the Association are attended by an officer of the Department. The main subjects of the Association's deliberations are the functioning, control and planning of markets.

(iv) The International Standards Organisation (ISO)

(c) OTHER INTERNATIONAL LIAISON

The Department is also concerned with the following international agreements in so far as they affect the agricultural sector:

- (i) The Trade Agreement with Zimbabwe
- (ii) The Trade Agreement with Malawi
- (iii) The Mozambique Convention
- (iv) The Customs Union Agreement with Botswana, Lesotho and Swaziland

During the period under review officers of the Department were members of the South African delegations which attended meetings of the Customs Union Commission.

(v) Arrangements with Bophuthatswana, Venda and Transkei concerning economic relations also received attention from officers of the Department

DIRECTORATE AGRICULTURAL TECHNICAL SERVICES

CO-OPERATION WITH AFRICAN COUNTRIES

1. SARCCUS conferences and meetings attended

Number of meetings	Number of officers
12	34

A strong South African delegation headed by Prof. S.A. Hulme attended the 17th General Meeting of SARCCUS in Malawi from 5 to 10 May 1980.

2 Visitors to African countries

Number of countries visited	Number of officers
5	14

OVERSEAS VISITS

(a) Attendance at congresses, meetings and symposia

Number of meetings	Number of countries	Number of officers
44	19	47

Doctors J.D. Burger, P.C. van Rooyen and J.G. Boyazoglu attended the 60th Congress and Annual General Meeting of the International Wine Office (OIV) held in Mexico - a very important congress for the South African wine industry.

A strong South African delegation which included the Chief Director of Livestock and Fisheries and the Director of Sea Fisheries attended the important ICSEAF Commission Meeting in Palma de Mallorca, Spain, during December 1980.

(b) Study tours and official visits

Number of tours	Number of countries visited	Number of officers
50	28	53

Dr W.J. Hugo, Mr E. Strydom and Mr N. Saulez accompanied a South African delegation to Taiwan to hold discussions on co-operation between the two countries in several areas, including agriculture.

Dr D.J. Agenbach undertook two overseas trips, with the result that the Agricultural Counsellor in Buenos Aires was reappointed and an

agreement for co-operation on agricultural matters was concluded between Spain and South Africa.

SCIENTIFIC AND OTHER VISITS

Number of visits	Number of countries	Number of visitors
46	19	173

This large number of visitors included four farmers' tour groups varying from 13 to 35 in number.

The Department also acted as host for the UPOV Fruit Working Group, the delegates to which included 18 from abroad.

Other important visits that merit special mention were those of Mr P.B. Arnold, the Minister of Water Affairs of South Australia and his party, who came to study irrigation in South Africa with the emphasis on the effective use of water and the application of poor quality water for irrigation, and that of Mr M. de Aldasoro, the

Spanish Secretary of Fisheries, who visited the Department for discussions in connection with a Fisheries Agreement between South Africa and Spain.

VISITS FROM AFRICAN COUNTRIES

Number of visits	Number of	Number of countries visitors
13	5	14

The purpose of these visits was mainly to gather information of an agricultural technical nature.

REPRESENTATION OVERSEAS

The accompanying table contains particulars of the activities of the various overseas representatives of the Department during the year under review.

Nature of activities		Europe	Washington	Canberra
1	Visits to research institutes, farms, experimental farms, etc.	150	71	73
2	Conferences and meetings attended	70	42	19
3	Special investigations reported on	7	72	2
4	Reports and publications supplied to the Department and to other organisations in the RSA	5 036	8 687	914
5	Number of visitors from South Africa -			
	a. for whom itineraries were drawn up and the chief arrangements made	126	20	2
	b. to whom assistance of some kind was given	215	2	34
6	Interviews granted to non-South Africans	191	22	24
7	Bursary and other South African students assisted	4	9	0
8	Material sent to South Africa			
	a. plant material (number of cultivars) and/or separate seed samples	323	2 263	26
	b. animal material	3	0	0
9	Newsletters compiled and sent to the Department	324	36	15

21. Statistical Annexures

FINANCES

(a) EXPENDITURE 1980/81

	Vote R	Expenditure R
Administration	14 956 000	16 618 804,85
Plant production promotion	13 258 000	14 046 949,77
Animal production promotion	29 622 000	30 962 965,02
Agricultural resource utilisation	13 784 000	14 046 592,78
Entrepreneur development	7 941 000	8 578 276,60
Sea fisheries	18 662 000	17 855 849,71
Supporting and associated services	14 611 000	16 846 502,11
Agricultural production economics	618 000	502 864,47
Agricultural marketing	18 023 000	16 806 359,91
Subsidies and Assistance	280 712 000	263 864 816,09
Agricultural financing	60 793 000	57 954 648,13
Thefts and losses		11 840,18
	472 980 000	458 096 469,62
Less: Internal charges	3 943 000	4 628 466,02
	469 037 000	453 468 003,60
Less: Cash discount		6 481,94
Plus: Salary adjustments from Vote 31	None	
Total	469 037 000	453 461 521,66

(b) REVENUE 1980/81

	R
Vaccine sales	2 870 909,65
Produce sales	4 401 652,62
Rent	196 198,84
Interest	6 341 495,43
Miscellaneous	27 894 054,66
Agricultural financing	23 261 310,78
Total	64 965 621,98

1980/81

MAJOR WORKS UNDER CONSTRUCTION

		R
Pretoria	Agricultural Building	
	Computer Centre	5 700 000
Stellenbosch	Elsenburg College of	
	Agriculture; Administrative	
	Research building	4 600 000
Dohne	Abattoir, Workshops and	
	Garages	531 000

1980/81

MAJOR WORKS COMPLETED

		R
Pietermaritzburg	Cedara College of Agriculture. Regional Headquarters, Lecture rooms and alterations to existing Admin. Building	3 000 000
Dohne	Agricultural Research Station: Animal Husbandry/Research Building	814 000
Bloemfontein	Offices for State Veterinarian	686 000

NEW LEGISLATION

Egg Production Control Amendment Act, No. 81 of 1980.

Agricultural Credit Amendment Act, No. 27 of 1980.

Sub-division of Agricultural Land Amendment Act, No. 18 of 1981.

Plant Breeders Rights Amendment Act, No. 14 of 1981.

Commission for Fresh Produce Markets Amendment Act, No. 25 of 1981.

Wine and Spirits Amendment Act, No. 87 of 1980.

TABLE 1 - Contribution of agriculture to the gross domestic product at current prices, 1971-1980

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980*
	R million									
Gross income	1 501,8	1 679,2	1 897,3	2 686,8	2 838,5	3 078,4	3 528,2	3 911,4	4 484,4	5 631,1
Supplementary payments from stabilisation funds	-	2,1	45,3	3,6	74,2	53,6	-	-	-	-
Intermediate goods and services	444,3	502,6	591,8	738,0	909,7	1 088,9	1 298,7	1 464,8	1 813,8	2 173,5
Own construction and farming services	17,7	20,3	21,7	22,9	28,4	35,0	38,5	44,0	50,7	59,1
Net change in live-stock inventory	-48,0	-26,4	+59,2	+95,4	+60,0	+44,8	+65,3	+28,9	-54,0	-46,6
Change in stocks	+ 4,3	+ 1,4	+15,4	+ 5,0	+ 7,0	+19,6	-	+13,4	+8,0	-10,9
Contribution to the GDP at factor income	1 031,5	1 169,8	1 356,5	2 068,5	1 950,0	2 035,3	2 333,3	2 532,9	2 675,3	3 459,2
Subsidies	5,5	5,1	3,3	-	-	-	-	-	-	-
Indirect taxes	9,4	11,2	12,0	13,2	14,3	16,5	23,7	24,9	26,1	27,2
Contribution to the GDP at purchasers' prices	1 035,4	1 175,9	1 365,2	2 081,7	1 964,3	2 051,8	2 357,0	2 557,8	2 701,4	3 486,4
Depreciation	100,4	108,7	116,7	126,4	138,2	162,0	180,8	205,5	226,0	244,8
Net contribution of the agricultural sector	935,0	1 067,2	1 248,5	1 955,3	1 826,1	1 889,8	2 176,2	2 352,3	2 475,4	3 241,6
Wages, salaries, interest and rent	312,4	352,8	403,2	475,9	549,1	664,8	739,4	796,7	889,1	959,6
Indirect taxes	9,4	11,2	12,0	13,2	14,3	16,5	23,7	24,9	26,1	27,2
Supplementary payments from stabilisation funds	-	2,1	45,3	3,6	74,2	53,6	-	-	-	-
Net farm income	613,2	705,3	878,6	1 469,8	1 336,9	1 262,1	1 413,1	1 530,7	1 560,2	2 254,8

*Preliminary

TABLE 2 - Gross value of agricultural production, 1971-1980

Year	Field products	Horticultural products	Livestock products	Total	Important single products						
					Maize	Wheat	Deciduous fruit	Citrus fruit	Wool	Stock slaughtered	Dairy products ¹
					R million						
1971	724,3	269,6	595,3	1 598,2	334,0	115,6	69,7	40,5	59,9	292,4	138,6
1972	837,1	299,0	728,4	1 864,5	397,2	131,4	81,3	41,6	105,0 ²	335,5	145,1
1973	648,0	348,5	936,9	1 933,4	197,4	120,8	93,5	40,8	142,8	438,0	160,9
1974	1 339,0	394,5	1 052,2	2 785,7	644,3	157,2	94,6	53,0	112,7	501,0	200,5
1975	1 257,2	492,9	1 137,3	2 887,4	576,2	175,7	125,6	65,6	104,9	506,2	241,0
1976	1 345,4	535,2	1 283,1	3 163,7	505,3	237,6	119,0	71,0	127,0	579,4	248,1
1977 ³	1 774,3	575,2	1 363,2	3 712,7	747,6	267,8	131,3	92,0	138,4	623,0	244,0
1978 ³	1 960,6	649,2	1 496,8	4 106,6	841,9	232,9	138,2	105,5	148,1	666,4	260,7
1979 ³	2 122,8	796,1	1 811,8	4 730,7	875,3	330,9	172,8	127,1	166,2	859,2	302,0
1980 ³	2 781,6	976,5	2 166,6	5 924,7	1 302,0	343,7	233,4	116,3	183,5	1 090,9	365,4

¹Including fresh milk

²Subsidy included

³Preliminary

TABLE 3 - Indexes of physical volume of agricultural production, 1971-1980

Year	Field products	Horticultural products	Livestock products	Total	Important single products						
					Maize	Wheat	Deciduous fruits	Wool	Stock slaughtered	Dairy products	Fresh milk
					Base 1975 = 100						
1971	124,4	110,7	100,5	112,1	140,3	116,2	119,8	87,0	104,2	99,2	94,4
1972	134,8	112,5	100,6	116,8	154,7	125,6	126,7	71,4	103,1	101,0	95,4
1973	91,4	112,6	104,7	100,3	67,8	133,7	117,9	83,9	103,1	96,6	96,6
1974	152,6	114,1	99,3	123,9	181,1	121,5	118,4	78,5	91,6	80,2	93,2
1975	131,3	122,7	103,7	118,2	148,4	126,6	136,9	82,4	94,3	82,1	91,2
1976	123,0	127,7	108,8	117,7	121,9	154,1	140,6	75,8	103,3	88,9	90,2
1977 ¹	147,0	120,4	113,9	128,8	158,4	142,9	121,4	78,8	114,0	78,4	87,9
1978 ¹	150,6	131,6	117,9	133,7	164,4	126,3	146,3	76,5	124,9	69,2	86,6
1979 ¹	133,6	135,7	123,4	129,6	134,9	144,0	157,2	63,2	138,7	72,8	85,3
1980 ¹	²	²	²	²	174,9	118,3	170,4	63,2	133,6	¹	¹

¹Preliminary

²Not available

TABLE 4 - Indexes of producer prices, 1975-1980

Year	Field products	Horticultural products	Livestock products	All products	Maize	Important single products				
						Wheat	Fruit	Wool	Stock slaughtered	Dairy products ¹
Base 1975 = 100										
1975	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
1976	107,8	101,3	113,2	108,7	104,8	112,2	103,5	129,6	113,0	107,9
1977	118,3	118,4	116,9	117,8	118,7	116,8	129,0	136,3	114,4	106,1
1978 ²	126,6	123,0	125,3	125,5	129,0	126,6	137,3	144,8	117,9	115,1
1979 ²	155,5	141,3	144,9	149,0	161,4	163,2	145,9	161,5	141,8	139,1
1980 ²	183,0	156,2	174,6	175,0	188,2	199,1	157,4	171,1	177,7	164,9

¹Including fresh milk

²Preliminary

TABLE 5 - Price indexes of farming requisites, 1971-1980

Year	All farming requisites	Machinery and implements	Fixed improvements	Short-term requisites	Fertiliser	Fuel	Stock feed	Packing material	Tractors	Implements
Base 1975 = 100										
1971	58	60	55	59	54	48	68	67	57	61
1972	63	65	58	63	59	51	72	72	64	64
1973	69	72	67	69	63	56	82	75	71	71
1974	82	81	82	82	71	87	91	81	78	79
1975	100	100	100	100	100	100	100	100	100	100
1976	116	118	121	114	107	133	111	108	125	118
1977	130	132	139	128	120	146	131	118	135	130
1978	148	153	157	145	140	152	151	131	163	146
1979	178	171	180	181	159	278	178	147	176	163
1980	207	188	201	215	187	356	215	168	190	178

TABLE 6 - Indexes of land prices in certain agro-economic regions, 1965/66-1978/79*

Year	Summer rainfall regions					Winter rainfall regions		Cattle grazing regions		Sheep grazing regions		
	B1	B2	B3	B4	B5	K1 and 2	K3 and 4	M1, 2, 3 and 4	M6	S8	S13	Natal
Base April 1970 - March 1971 = 100												
1965/66-1967/68	77	75		82	67	105	118	73	74	105	121	
1966/67-1968/69	81	83		98	80	110	118	79	86	97	114	
1967/68-1969/70	90	102		105	94	125	121	93	99	92	118	
1968/69-1970/71	98	107		103	100	127	109	93	106	96	110	
1969/70-1971/72	103	120		100	107	137	105	102	110	107	106	
1970/71-1972/73	109	135	110	106	107	136	101	103	124	114	99	108
1971/72-1973/74	126	160	120	111	106	155	107	114	152	114	104	121
1972/73-1974/75	152	176	136	122	102	165	118	128	190	123	109	138
1973/74-1975/76	189	197	146	146	119	195	140	153	249	148	112	162
1974/75-1976/77	206	219	158	162	145	232	150	169	320	165	120	175
1975/76-1977/78	245	239	174	182	168	244	196	198	373	177	127	194
1976/77-1978/79	238	263	198	190	181	238	224	223	345	182	154	190

*Compiled on basis of transfers of rural immovable property, published by the Department of Statistics

Key to codes:		1965/66-1969/70
B1	-	Bethal, Heidelberg, Standerton; Heidelberg from 1970/71 replaced by Balfour
B2	-	Frankfort, Heilbron; Frankfort since 1970/71 replaced by Koppies
B4	-	Klerksdorp, Lichtenburg, Schweizer-Reneke, Ventersdorp, Wolmaransstad
B5	-	Bothaville, Hoopstad, Kroonstad, Vredefort; Hoopstad since 1970/71 replaced by Odendaalsrus
K1 and 2	-	Malmesbury, Piketberg
K3 and 4	-	Bredasdorp, Caledon, Swellendam
M1, 2, 3 and 4	-	Kuruman, Mafikeng, Vryburg
M6	-	Potgietersrus, Rustenburg, Waterberg, Soutpansberg; Rustenburg since 1970/71 replaced by Thabazimbi
S8	-	Calvinia, Carnarvon, Fraserburg, Kenhardt, Sutherland
S13	-	Aberdeen, Beaufort-West, Britstown, Colesberg, Graaff-Reinet, Hanover, Victoria-West

Key to codes:		1970/71-1978/79
B1	-	Balfour, Bethal, Delmas, Frankfort, Standerton
B2	-	Heilbron, Koppies
B3	-	Bethlehem, Clocolan, Ficksburg, Fouriesburg, Ladybrand
B4	-	Coligny, Delareyville, Klerksdorp, Lichtenburg, Schweizer-Reneke, Ventersdorp, Wolmanransstad
B5	-	Bothaville, Kroonstad, Odendaalsrus, Viljoenskroon, Vredefort, Wesselsbron
K1 and 2	-	Malmesbury, Piketberg
K3 and 4	-	Bredasdorp, Caledon, Swellendam
M1, 2, 3 and 4	-	Kuruman, Mafikeng, Vryburg
M6	-	Potgietersrus, Soutpansberg, Thabazimbi, Waterberg
S8	-	Calvinia, Carnarvon, Fraserburg, Kenhardt, Sutherland
S13	-	Aberdeen, Beaufort-West, Britstown, Colesberg, Graaff-Reinet, Hanover, Victoria-West
Natal	-	Kliprivier, Pietermaritzburg, Umvoti, Utrecht, Vryheid, Weenen

TABLE 7 - Free on board value of exports and imports of agricultural products, 1971-1980¹

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980 ²
	R 1 000									
EXPORTS										
Total SA products (excluding gold)	1 418 255	1 853 330	2 427 398	3 339 461	3 983 212	4 532 071	5 863 237	7 333 301	9 471 379	9 717 400
Total unprocessed agricultural products	229 178	390 315	382 753	504 784	642 103	586 633	611 317	776 241	825 916	986 529
Total agricultural products	457 632	750 567	788 078	1 016 073	1 249 003	1 237 440	1 337 542	1 543 830	1 692 279	1 787 382
Most important agricultural products exported										
Wool	50 958	115 497	166 394	118 661	116 816	173 693	190 658	175 778	183 032	219 652
Mohair	4 346	8 279	12 394	9 891	18 073	24 710	23 913	38 274	35 316	25 613
Karakul pelts	15 137	18 323	23 226	15 804	17 251	25 958	41 402	54 852	57 875	57 871
Hides and skins	19 796	37 206	42 025	33 433	25 788	47 058	49 703	69 373	109 582	61 295
Maize and maize products	62 344	140 623	77 385	203 375	302 543	236 452	190 088	282 053	222 401	423 075
Sugar	69 088	124 457	106 203	232 812	282 282	209 795	233 429	169 232	155 033	386 971
Groundnuts	11 029	7 336	10 086	11 760	17 024	7 951	8 003	16 371	20 995	19 378
Preserved fruit and jams	48 379	64 653	80 269	85 458	103 884	131 758	126 085	130 971	148 335	97 308
Citrus fruit	36 316	45 551	43 918	57 699	110 090	64 165	94 207	114 793	142 481	100 511
Deciduous fruit and table grapes	38 378	50 529	41 050	49 084	59 301	82 719	56 096	97 214	122 790	128 497
IMPORTS										
Total imported	2 880 280	2 621 821	3 275 367	4 898 018	5 545 041	5 859 372	5 118 328	6 253 425	7 012 712	
Total unprocessed agricultural products imported	48 136	51 159	80 059	111 910	103 630	127 659	162 507	143 559	148 895	200 218
Most important agricultural products imported										
Wheat	2 008	684	619	847	98	50	85	492	1 014	1 652
Rice	11 681	11 189	19 684	28 982	26 049	26 775	30 879	33 953	41 103	41 303
Dry beans	847	257	2 229	297	794	1 314	808	775	431	331
Coffee	7 145	6 722	8 820	12 588	14 564	23 886	50 638	21 821	39 866	35 058
Cocoa beans	2 494	3 006	3 204	4 916	9 046	7 534	6 816	14 329	10 477	13 188
Sisal	220	167	463	405	207	249	324	76	32	685
Tea	14 074	15 217	14 573	17 381	19 691	22 879	36 061	28 272	21 676	25 051
Bananas	450	339	346	407	116	22	10	7	3	2
Rubber (unprocessed)	7 190	8 652	16 079	25 105	16 416	27 945	28 385	34 736	43 756	54 619

¹Source: Department of Customs and Excise

²Preliminary

TABLE 8 - Subsidies and rebates: Amounts paid by the Directorate of Agricultural Economics and Marketing, 1972-1981

Financial year ending March 31	Subsidies in respect of specified enterprises					Rebate on transport of -						
	Maize (mainly distribution margin) ¹	Grain sorghum ^{1, 2}	Wheat (bread)	Dairy products (mainly butter)	Total	Stock feed	Live-stock	Fertilisers	Total	Subsidy on fertilisers	Subsidy on feed	Grant total
	R1 000											
1972	30 050	607	29 510	5 880	66 047	373	83	2 176	2 632	18 297	1 156	88 132
1973	27 634	407	40 253	5 700	73 994	116	4	2 253	2 373	14 442	4	90 813
1974	23 874	33	26 787	8 220	58 914	114	-	2 064	2 208	14 454	-	75 576
1975	31 475	553	44 622	12 631	89 281	19	-	2 035	2 054	15 362	-	106 697
1976	54 840	892	61 638	8 279	125 649	16	-	2 307	2 323	18 443	-	146 415
1977	61 909	1 014	67 766	7 197	137 886	1	-	3 041	3 042	17 833	-	158 761
1978	51 654	976	70 227	125 027	-	-	-	4 016	4 016	14 179	-	143 222
1979	47 924	1 000	57 361	4 888	111 173	1 573	-	3 299	4 872	8 402	-	124 447
1980	44 667	83	116 393	3 725	164 868	2 358	-	-	2 358	3 469	3 886	174 581
1981 ¹	59 393	-	162 054	3 807	225 254	3 672	-	-	3 672	10 983	14 310	254 219

¹Grain sorghum used in feed mixtures as substitute for yellow maize

²Rebate on transport included

³Preliminary

TABLE 9 - Adjustments in the prices of certain agricultural products, 1974/75-1981/82

	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82
1. Maize (R/t) ¹ <i>Net producer price for uncleaned</i>								
Best grades - white	57,00 ²	62,00 ³	65,00	73,60	79,95	100,15	118,25	118,25
- yellow	57,00 ²	62,00 ³	65,00	73,60	79,95	100,00	115,00	115,00
<i>Selling price of Maize Board</i>								
Best grades - white	47,00	50,00	59,00	71,50	83,10	102,15	122,65	134,15
- yellow	47,00	50,00	59,00	71,50	83,10	100,00	122,40	134,00
2. Grain sorghum (R/t) ¹ <i>Floor price for best grade uncleaned</i>	55,10	62,00	71,50	80,50	74,55	80,00	90,00	96,10
3. Winter cereals (R/t) ¹ <i>Fixed producer price</i>								
A1 - wheat	101,21	106,15	121,35	121,35	136,29	185,15	216,74 ⁹	
B1 - barley	88,45	100,19	105,00	105,00	114,65	120,69	177,88 ⁹	
Grade 1 - oats	70,16	74,52	74,52	74,52	84,60	102,78	123,84 ⁹	
Grade 1 - rye	84,47	93,16	100,00	100,00	118,90	174,94	204,25 ⁹	
4. Dairy products (a) Industrial ⁴ <i>Basic producer price</i>								
Butterfat (gr. 1, c/kg)	143,00	163,00	163,00	112,00	185,00	220,00	256,00	278,00
Cheesemilk (3,5 % fat, c/100 kg)	888,00	1 010,00	1 010,00	904,00	1 150,00	1 550,00	1 745,00	1 905,00
Condensing milk (3,5 % fat, c/100 kg)	888,00	1 010,00	1 010,00	904,00	1 150,00	1 550,00	1 745,00	1 905,00
<i>Consumer price (c/kg)</i>								
Choice butter ⁵	130,00	140,00	140,00	160,00	184,00	224,00	258,00	288,00
Cheese (Cheddar)	148,00	158,00	158,00	173,00	200,00	248,00	286,00	348,00
(b) Fresh milk (c/l) ⁶ <i>Fixed producer price</i>								
Witwatersrand	12,70	15,70	17,20	17,20	19,60	19,60	26,60	30,10
Pretoria	12,70	15,70	17,30	17,30	19,70	23,20	26,70	31,00
Bloemfontein	12,70	15,10	16,30	16,30	18,70	22,20	25,70	30,00
Cape Town	12,70	15,40	16,60	16,60	19,00	22,50	26,00	30,50
Western Transvaal	12,60	15,60	17,10	17,10	19,50	23,00	26,50	30,50
5. Beef (c/kg) <i>Floor price for grade 1, class B</i>	68,00	76,00	84,00	95,00	95,00	100,00 ⁷	120,00 ⁸	

¹ Excluding price of bags

² Supplementary payment of R7,00 per ton in respect of the 1974 crop from the stabilisation fund of the Maize Board included

³ Supplementary payment R6,00 per ton in respect of the 1975 crop from the stabilisation fund of the Maize Board included

⁴ As at 1 June

⁵ Actual selling price with consumer subsidy taken into account

⁶ As at 1 June

⁷ Basic floor price of grade 1B

⁸ Floor price of grade 1 BY

⁹ Net producer price

